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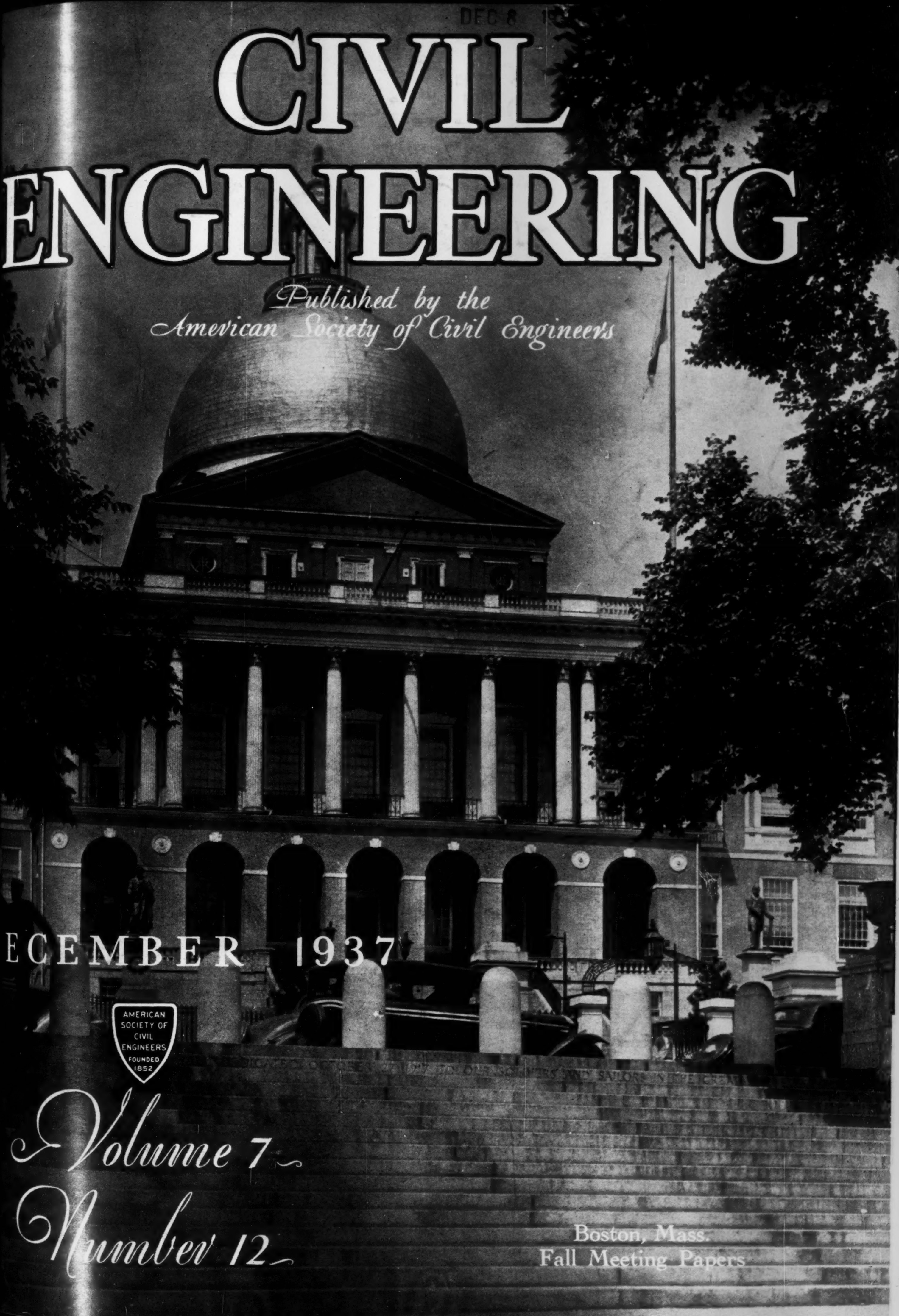

ECEMBER 1937

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

Volume 7
Number 12

Boston, Mass.
Fall Meeting Papers

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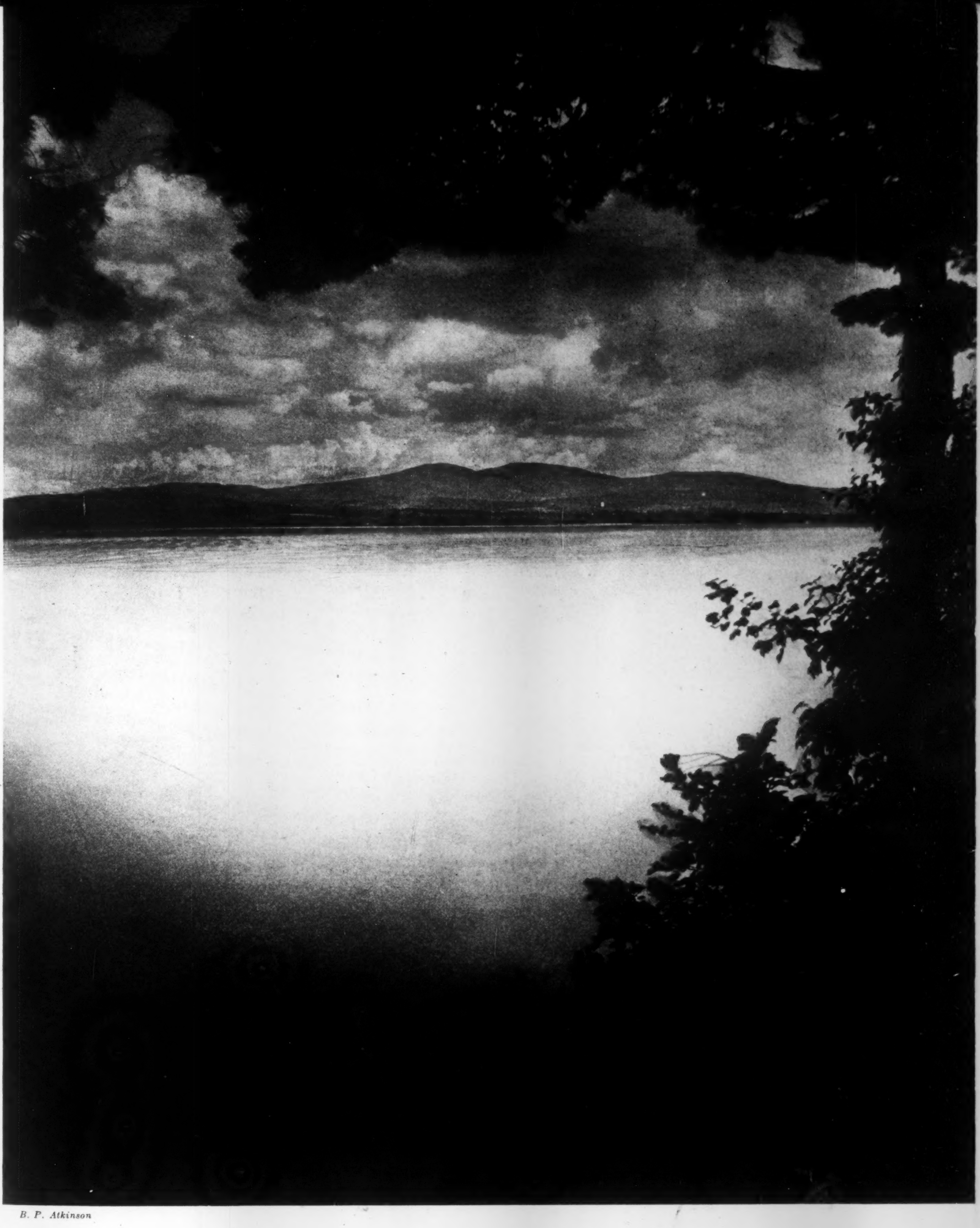

B. P. Atkinson

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as Seen from Lake Winnisquam

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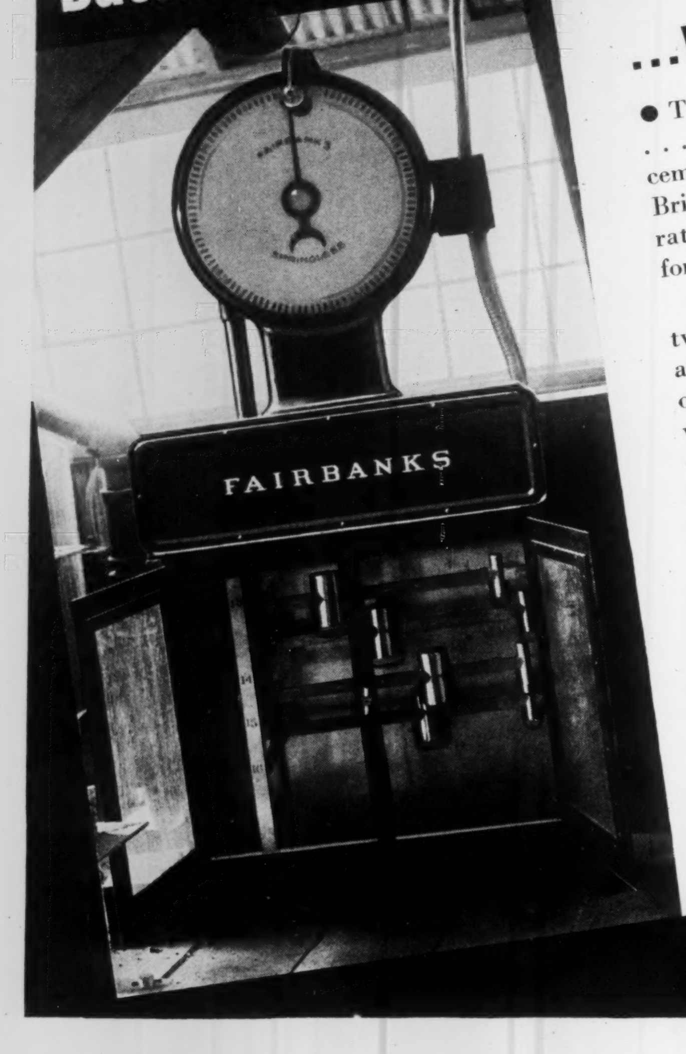

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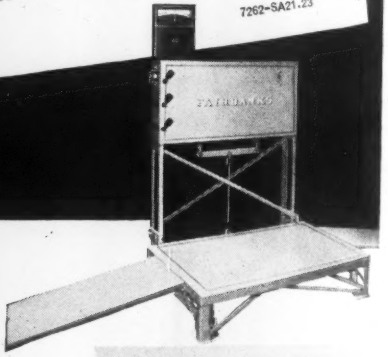

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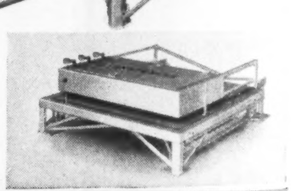

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Among Our Writers

Karl T. Compton served at various times as a faculty member at Wooster, Reed, and Princeton, principally in the field of physics, before his election as president of the Massachusetts Institute of Technology in 1930. He has been active for many years on important scientific and research boards. He is also the author of approximately a hundred publications, dealing with many different subjects in the field of physics.

Glennon Gilboy holds a bachelor's degree in civil engineering, also S.M. and Sc.D. degrees from the Massachusetts Institute of Technology. Since 1929 he has been in charge of research and instruction in soil mechanics at the Institute, and since 1934 has acted as consultant to the federal government on flood-control dams in 5 different Army Engineer districts.

Walter Gropius, born and educated in Germany, has practiced architecture in that country, in England, and in the United States, where he was appointed during the past year professor of architecture in the graduate school of design at Harvard University. Dr. Gropius also taught in Weimar, Germany, where he united and reorganized an art academy and an arts and crafts school under the name of the Staatliches Bauhaus.

William F. Clapp was in charge of the departments of *Mollusca*, *Bryozoa*, and *Tunicates* at Harvard for 15 years. For the past 11 years he has been connected with the Massachusetts Institute of Technology in the department of biology, but since 1930 has devoted practically all of his time to marine biological research in his private laboratory.

Justin R. Hartzog graduated from Cornell and Denison universities, and for 10 years was associated with the late John Nolen in the preparation of city and regional plans in many communities. He is also town planner of Greenhills, a new Resettlement Administration town near Cincinnati, Ohio, and National Resources Committee state planning consultant for New Hampshire.

Frank H. Malley has had 15 years' experience in various types of civil engineering work. Previous to 1930 his principal engagement was with Olmstead Brothers, of Brookline, Mass., on design and construction of streets, parks, and sanitary engineering works. Since September 1930 he has been with the Boston City Planning Board, which he now serves as acting executive secretary.

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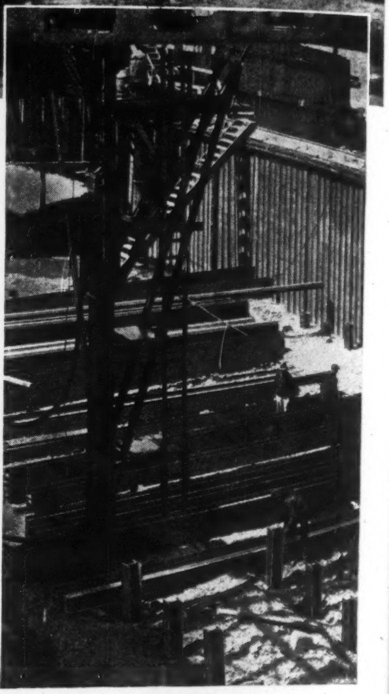

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UNITED STATES STEEL

Something to Think About

A Series of Reflective Comments Sponsored by the Committee on Publications

Let the Engineer Do His Job

By Karl T. Compton

President of the Massachusetts Institute of Technology, Cambridge, Mass.;
Honorary Member, Boston Society of Civil Engineers

In recent years many critics of the social, political, and economic scene have been calling the engineer to task for not taking a more active interest in problems of public policy. Engineers themselves have recognized the rapidly broadening responsibilities of the profession, and the national engineering societies have given increasing attention to the problem of the relations of the engineer to government. At the recent Boston meeting several papers such as this one by Dr. Compton were devoted to the subject. It is especially fitting therefore that his challenging words, based on his address at the first session, October 6, should also open the December issue of "Civil Engineering," devoted to a general summary of this notable meeting.

His address does much to clarify the relationship between the profession and national administrations; to make it clear that the blame for the apparent failure to give due weight to the engineer's viewpoint in this field must lie with government rather than with the engineer. Too often engineer's reports on government projects never see the light of day. The public is led to believe that many undertakings are justified on a basis of sound engineering economics whereas no such basis exists and such projects, if at all justifiable, must be undertaken for purely social or humanitarian reasons. As Dr. Compton suggests, the public is entitled to know the economic facts of any proposed undertaking and the engineer is the expert who is competent to uncover and appraise these facts. His studies should not be ignored, shelved, or forgotten.

GRANTING that human welfare depends on many factors, material and spiritual, individual and social, yet we all agree that the welfare of our country as a whole and of its citizens individually is vitally dependent on the work of engineers. We agree, moreover, that this welfare depends on the introduction into business and public affairs of the trained intelligence; the careful analysis of objectives, methods, costs, and relative values; the efficient and economical handling of enterprises; and the keen sense of public responsibility which are basically characteristic of the engineer's approach to his problems.

The extent of the engineer's responsibilities is rapidly growing. On the one hand technological advances are giving him more activities, objectives, and instruments. On the other hand, the universal pressure on governments to undertake large-scale projects for the benefit of their citizens is giving him an important rôle in affairs of unprecedented magnitude. Not only does the economic health of the country depend in an important way on the ability with which engineers do their job and on the extent to which their expert advice is followed, but the moral health of government and people alike is affected by the engineer's integrity and courage. Both of these elements come strongly into play in the conduct of the great government public-works projects.

Advice Needed on Public and Private Enterprises.~ While the engineer should have a broad interest in public affairs and perform his duties as a good citizen, we must admit that his field of expert knowledge and skill is a limited one, as is equally true with every other profession such as medicine, or law, or finance. Within his special field, however, the engineer is the highest and best authority. As such, his expert judgment should be followed in the analysis and administration of all important projects which fall within this category, whether under private or public auspices, for to do otherwise is to lose the advantage of the best experience and knowledge which is available.

If competent engineering advice is not sought or is not followed in a private enterprise, it is principally the private sponsor of this enterprise who suffers. If, however, this advice is neglected in a public enterprise, then the nation, collectively and individually, suffers.

There is undoubted opportunity for considerable improvement in the administration of those public affairs that are essentially of an engineering nature, whether they be the responsibility of municipality, or state, or federal government, and it is likely that this improvement can only come about through public enlightenment by education and experience. Professional society meetings like the recent one of the American Society of Civil Engineers have two principal functions—to analyze and compare experiences, and to educate not only the membership of the Society but also the public at large through the results of these experiences.

To Effect Better Administration. ~We should use every means to effect improvement in the handling of publicly administered engineering projects in at least three directions. The first of these is the improvement of the technical quality of engineering services employed. This involves not only the improvement of the engineering profession itself, but also the better education of public officials as to the quality of engineering services and how these services can best be procured.

The second improvement is in the integrity of engineers who are connected with government work. The pressure to favor certain construction materials or to appoint certain officers or to hire certain workmen for reasons of favoritism, or political pull, or on any other account than suitability for the job, is terrific. Yet, if such pressure be not resisted, the engineering work deteriorates, morale drops, the festering infection of the patronage system gains hold, and the public suffers.

Publicity and Independence Are Essential. ~Two safeguards against this danger may be suggested. One is the powerful, united backing of the engineering profession to oppose such pressure through outspoken publicity of the facts and education of the public to understand and be concerned about the dangers. Even an organized professional boycott of government projects which are not reasonably protected from patronage pressure or graft is not too strong a measure for maintaining the integrity of the engineering profession and protecting the public.

The other safeguard was recently suggested by Arthur E. Morgan, M. Am. Soc. C.E., in an address before the Detroit meeting of the Society. Noting that political pressure and favoritism are so common in our governmental agencies, Dr. Morgan suggests that every engineer in public service is unfitted for his job unless he is willing to live sufficiently within his income to accumulate savings that will give his family a cushion of protection so that he can dare to be honest even at the risk of losing his job.

I would therefore suggest that the engineering societies undertake protection of their members through investigations and wide publicity of notorious cases of improper pressure for unethical practice, in some such manner as has been so effectively carried through by the American Association of University Professors.

Differentiating Engineering from Other Considerations. ~The third desirable improvement would be a clear distinction between political or social considerations on the one hand and considerations of engineering efficiency on the other, in the information and explanations given to the public. We will probably admit that even an inefficient engineering project may possibly be justified by special social conditions. Such conditions have existed during the past depression, and most of us agree that there was justification for governmental agencies to provide useful work in the time of desperate distress through unemployment. If this is done, however, the best interests of the situation will be served if the public is clearly and accurately informed of the conditions and reasons pertaining to the project. In no other way can the governmental agency, on the one hand, protect itself from justifiable criticism, or can the public, on the other hand, protect itself from improper exploitation.

In the Passamaquoddy project, for example, the government would have escaped much criticism and the public might have been spared much expense if the government's announcements had frankly and accurately stated (1) the estimated cost per kilowatt-hour of the tidal project, (2) the comparative cost of a tidewater steam generating power plant of equal capacity, (3) the engineering-economic appraisal of the project by competent engineers free of political pressure (such as the U. S. Army Engineers or a distinguished commission), (4) social reasons which led to favorable action on the project despite the unfavorable aspects of (1), (2), and (3). Instead of this, however, an attempt was made to sell the project to the people in glowing terms as an engineering-economic triumph, and the public was left to learn the real facts as best it could—with the well-known inevitable reaction.

The Public Deserves Frankness. ~Similarly, in the TVA project, which appears to be a splendid job of technical engineering and which was frankly announced as a great experiment in regional planning, evidence is already claimed in competent quarters that the government is not interpreting the results of this experiment with engineering honesty, in that the relative costs of flood control and navigation on one hand, and power development on the other, have been written on the books in such manner as to make the cost of the government power appear less than it really is, in the judgment of impartial engineers. Such practice is unfair to the privately owned public utilities, which cannot cover up misstatements by taxation of the public; if persisted in it will destroy the value of TVA as a great experiment, since experiments are worse than valueless if their results are inaccurately reported. Here again, the public interest would be served by investigation and report on this matter by a commission of very distinguished engineers of unquestioned independence of judgment.

Lack of a clear explanation to the public of the conditions under which public engineering projects are undertaken may arise either from political considerations, such as fear that the public will not approve if it knows the true facts—an attitude which is inherently dishonest—or from ignorance of the real factors of the situation, which may arise from failure to secure competent engineering advice. Misrepresentation through wilful purpose and through ignorance are equally reprehensible.

Some Pressing Obligations. ~Is it too much to hope, therefore, that there may come (1) exposition of the facts with reference to the engineering-economic aspects of great public engineering enterprises; (2) better education of engineers themselves in the handling of such enterprises; (3) enlightenment of the public in analyzing the issues involved; and (4) powerful suggestion to government officers that the facts and reasons involved in the expenditure of large public moneys be frankly stated on competent authority?

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Volume 7

CIVIL ENGINEERING
December 1937

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Aspects of Public-Works Construction

Examining the Economic Justification for Parts of the Public-Works Program

Critical reviews of public-works construction, chiefly as typified by large federal projects in the hydraulic field, were presented in four addresses before the Engineering-Economics and Finance Division on October 7, 1937, at the Society's Fall Meeting in Boston. Brief editorial summaries of these addresses are included herewith, in view of the fact that they may be published in full in a forthcoming issue of "Proceedings."

In the opening summary, Henry E. Riggs, Official Nominee for President of the Society for 1938, characterizes the Passamaquoddy, Missouri River, and Columbia Basin projects as examples of uneconomic public construction. He emphasizes the necessity for long-time planning of such works by Congress itself, and the need for establishing definite requirements as to accounting, publicity of statistics, and elimination of subsidies.

The second paper, by William J. Wilgus, Honorary Member of the Society, reviews the Florida Ship Canal and shows its lack of economic justification. A better use for the funds involved, he says, would be to provide needed additional public thoroughfares for growing automobile traffic, thereby serving a greater need and spreading employment much more widely.

Many different federal public-works projects are examined in the paper by Daniel W. Mead, Past-President of the Society, with special attention to activities of the Tennessee Valley Authority. It is the duty of the engineering profession, says Dr. Mead, to develop public opinion to the point where thorough investigation, sound judgment, and sound economics will be demanded for such undertakings.

In the final paper of the group, Frederic H. Fay outlines the economic advantages of orderly planning in public-works construction. The basic requirements for a controlled program, he says, are long-range advance planning and budgeting on the part of all agencies, and full participation on the part of state and local political subdivisions instead of throwing almost all of the burden on the federal government.

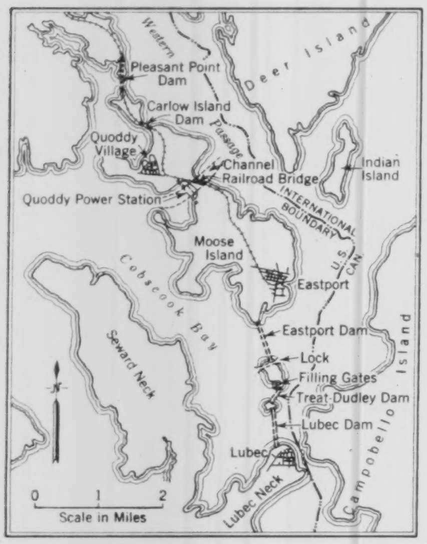
Hazards of Uneconomic Public Works

Is the nation justified, in a time of great stress, and of rapidly rising national debt, in engaging in business ventures that are new to government in the United States? Is it economically sound to spend vast sums in building works for the far-distant future that are distinctly not needed now? Is it wise to build without long and careful planning when the building involves many millions of dollars? Is a project sound when it can be seriously questioned whether there is a public need for it, a demand for its services, or a doubt as to whether it can be self-liquidating?

With these basic questions, Henry Earle Riggs, M. Am. Soc. C.E., honorary professor of civil engineering, University of Michigan, opened the discussion of public works economics at the 1937 Fall Meeting at Boston. His paper was "an attempt to present the available evidence on public works projects," of both the present and preceding administrations, that "can clearly be classified as failures of publicly owned state and federal business undertakings." The object of this review was to direct attention to the need for long-time planning, by Congress itself, of federal public works; and the need for establishing definite requirements as to accounting, publicity of statistics, and the elimination of subsidy in connection with the operation of any publicly owned business or public-service enterprise.

Contrary to some press reports, Dr. Riggs made no comments reflecting on the integrity or skill of the engineers engaged on public-works projects. Rather, he specifically stated: "No criticism is made or intended to be implied of the design or construction methods of the projects which are discussed. The work of the engineers on the design and the handling of the field work of construction on all the major projects I have visited is excellent." What he did question was the economic justification of certain large projects as relief undertakings; and he pointed out that many of them have been selected by agencies other than Congress, in some cases in the face of adverse recommendations by competent engineers.

Supporting his comments by detailed reference to many official reports, he referred to a number of government projects. The first example selected was the Passamaquoddy tidal power scheme. The plan, he said, had been twice rejected by PWA in 1933, and again turned down as unjustifiable after hearings by the Federal Power Commission. Notwithstanding, in 1935, Secretary Ickes' allotment board approved an initial allotment of $10,000,000 for construction of the project at an estimated total cost of $36,284,000. During the preliminary construction work extensive studies were made, resulting in a revised estimate of cost in the neighborhood of $62,000,000. The report containing that estimate, and a later review by three independent consulting engineers, were never made public. Some $6,000,000 had been expended up to the time Congress refused to make further appropriations. That amount represents approximately the total cost of a steam plant that could have supplied the same amount of power as predicted for the tidal project. Actually there was not even a market for power at that location.



PRINCIPAL FEATURES OF THE PASSAMAQUODDY TIDAL POWER PROJECT

As a second illustration, Dr. Riggs reviewed the Missouri River navigation project, on which, by the time Fort Peck is completed, over a quarter billion dollars will have been expended since the initial appropriation in 1876. All but $95,000,000 of this expenditure has been made since June 30, 1933. It was noted that the total cost of all capital and maintenance expenditures on the Great Lakes between 1824 and 1936, including work on harbors and connecting rivers, was almost exactly the same as the appropriations on the Missouri to the same date. Yet 1935 gross traffic on the Lakes totaled more than 101 times as much as that on the Missouri, and nearly all the latter traffic was in construction material, and therefore of a temporary nature.

As for the Columbia River projects (Bonneville and Grand Coulee), it was pointed out that the ultimate combined kilowatt capacity of the two power plants will be greater than that of all classes of generating equipment in any state except New York and California (1935 figures). The ten billion kilowatt hours they will be able to produce annually is almost $2\frac{1}{4}$ times the present total power output of all plants in Oregon, Washington, and Idaho—the three states in which they must find their market.

Actually, the plan under which Grand Coulee is now being built is the first step in a gigantic project to irrigate more than a million acres. But the feasibility of this irrigation depends on the sale of practically the entire output of primary power from the Grand Coulee plant at a remunerative rate. A report to this effect, made by Army Engineers and dated March 29, 1932, was available when the project was decided upon and is full of sound argument why Grand Coulee should not be built. It is to be hoped that Congress will not take hasty action in approving further appropriations for this project without the most complete expert study. Such a project, said Dr. Riggs, "does not fall in the class of emergency relief works. It should never have been adopted without the full discussion and consideration of Congress."

Too much emphasis cannot be placed on the fact that every dollar invested by the government for navigation, irrigation, or power, is a dollar added to the national debt. The same business principles should control the selection of public construction projects that are to render a service the public must pay for as would prevail in the case of a successful private undertaking of the same sort The ultimate cost to the taxpayer is the final cost of the project, with all the auxiliary construction necessary for its complete use, plus all interest and other fixed charges, and all deficits in operation and maintenance.

Yet many current projects were hastily approved by temporary emergency boards acting under virtual wartime pressure, on the basis of incomplete plans. Future losses cannot be cured by writing off part or all of the capital account. Doing so may make a given project look better, but it retires no bonds and does not reduce the taxpayer's burden of interest.

Bonneville Dam affords an excellent example of contingent expense due to hasty adoption of preliminary plans. In 1934 the total cost was estimated at $31,000,000. A change in location of the dam, provisions for protecting the salmon industry, and other revisions brought the estimated cost by 1936 to $51,000,000. Again: The 1934 estimate for Fort Peck was $86,000,000; the present revised estimate is $108,000,000. Apparently the first estimates of cost of these major public-works projects do not represent the final cost. Tens of millions of dollars more will have to be provided to complete the work now under way.

Auxiliary construction required by such projects, of which no mention is made at the time of approval of the work, constitutes another great source of expense. A transmission and distribution system for Bonneville, for example, is estimated to cost $43,270,000.

As examples of unsuccessful projects now in operation at a loss, Dr. Riggs cited the New York Barge Canal, the Alaska Railroad, the Inland Waterways Corporation, and several other undertakings. They cause one, he said, to be decidedly pessimistic as to the outcome of the many large projects now under way.

Private ownership has of course had many failures, but the evils of private management "can be and should be cured by government regulation." This is a legitimate function of government that has proved its worth in the last fifty years. One issue clearly raised by the current program is whether we are to continue to favor individual initiative, regulated by law, or adopt the policy of nationalization of utilities and ultimately bring all industry and labor under the control of government.

Members of the profession whose hands are not tied should freely tell the facts. They should discuss the economics as well as the technical features of public works. "Engineers, better perhaps than anyone else, can advise the public on the economic soundness of public works, especially those that should be self-liquidating. We fail in our duty if we keep silence."

The Florida Ship Canal and Other Projects

IN CONTINUING the symposium, William J. Wilgus Hon. M. Am. Soc. C.E., consulting engineer of Ascutney, Vt., stressed the need for considering the public-works policy in a purely non-partisan spirit. "I would not give the impression," he said, "that I disbelieve in the creation of worth-while public works of the type we are considering. I hold no brief for any private utility corporation. Neither do I hold with those who would maintain our unemployed in corrosive idleness rather than at self-respecting work at a somewhat greater expense from which the public gains material and spiritual returns. But the work in fact must be worth while in the public interest and not uneconomic and wasteful."

He added that public works need not suffer from the evils of corrupt or incompetent management, and pointed to admirably run city managerships and publicly owned water works, to the commercial activities of the Port of New York Authority, and to many works under the jurisdiction of the Army engineers, as cases in point. In fact, "under proper safeguards and conditions, it is possible to run public enterprises with honesty, competence, and resourcefulness, coupled with a strict observance of proper accounting at all times open to the public. The quicker we realize this, and prepare for it, the better off our country will be. With public ownership of railways and other utilities in the offing, it behooves us to abandon a King Canute–like attitude of negation and to favor a constructive course leading to a reasonably satisfactory conclusion. Holding these views it will be understandable why I feel that it is deeply to be regretted that the gargantuan projects dwelt upon by Professor Riggs have been promoted by the government without at the same time offering evidence that they hold promise within a reasonable time of becoming economically justifiable under efficient management."

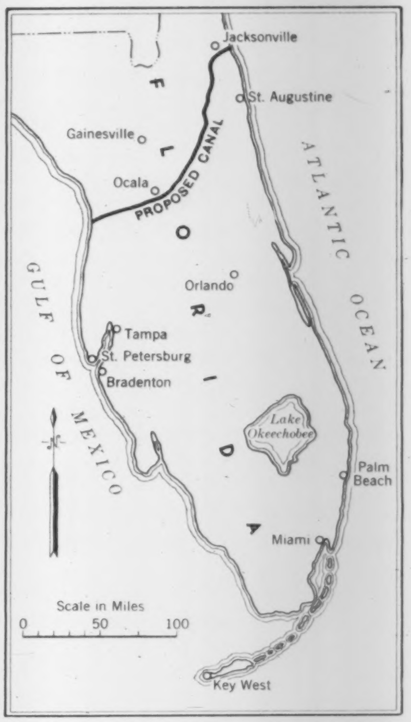
In judging the merits or demerits of public-works projects from the economic angle, caution must be used. Vision, or prophecy, has been the moving cause of some of man's most notable achievements. As a single example may be mentioned the Canadian Pacific Railway, "built by men of vision across plains and mountains then unpeopled and undeveloped, with buffalo bones at first as the only freight in sight." Perhaps developments in the field of electrometallurgy, the creation of new manufacturing centers, and the reclamation of waste land may some day provide an economic justification for such projects as Grand Coulee. But wishful thinking and idle guessing should carry no weight in prophesying their future. "We have a right to ask just what line of reasoning in this respect has guided our governmental agencies, so that an intelligent conclusion may be reached as to its soundness, and as to the amount of carrying charges that necessarily must be borne by the people of the United States before the project in each instance will perhaps become self-supporting."

Colonel Wilgus then turned to specific consideration of the Florida Ship Canal project, which he said had aspects even more forbidding than those of Passamaquoddy, Fort Peck, and Grand Coulee. The estimated cost of this work, he said, has risen in the past four years from $115,000,000 to as high as $291,843,000, with the assurance of a marked increase, of unknown size, above the latter figure should a change be found necessary from sea-level to lock design, or in case serious damages should be incurred through injury to Florida's underground water supply.

The estimate of the carrying charges to be borne by the people of the United States on this project, if completed, has risen in the same four years from $7,250,000 to as high as $14,930,000 per annum, while the maximum estimate of benefits is $9,553,244 per annum—part of which would go to foreign beneficiaries. This constitutes in effect a subsidy to private interests, from which the people of the United States as a whole would gain nothing other than a doubtful lowering of freight rates of unknown extent. In failing so signally to show benefits in excess of carrying charges, the project falls far short of meeting the condition laid down by the President that, to have his approval, it should in effect bring to the people of the United States the assurance that they would get their money back.

The possibility of grave injury to the underground water supply of Florida, through the building of a sea-level canal, is to be viewed with concern, and consideration should also be given to the disruption of Florida's highway system along the canal, involving the creation of needed future crossings at the expense of the state. Further, the modernizing of the country's merchant marine, which would result in the use of speedier vessels in the Gulf-Atlantic trade, will go far to making the canal obsolete at an early date—for unless it would provide a substantial saving in time, the canal route would be less desirable than the present, safer, open-sea route around the peninsula.

"To me, therefore," said Colonel Wilgus, "the Florida Ship Canal project is without a single argument in its favor, and should not receive the stamp of approval by Congress accompanied by appropriations for its continuance. It is better to abandon what was started as a relief measure at a cost of $5,400,000 of federal money and an unknown sum thus far expended by local interests for right of way, than to throw good money after bad."



Route of Proposed Florida Canal

To take this stand against the financing of useless public works does not mean that federal funds should not be devoted to the construction of really worthwhile projects to give work to the unemployed. "The money saved from loss on uneconomic enterprises like the Florida Ship Canal may and should be devoted to the supplying of such crying needs as added public thoroughfares for our rapidly growing automobile traffic.

"For instance, the building of an International Parkway along the Appalachian uplift, in cooperation with Canada, connecting many national and state parks and forests and other recreational areas, serving enormous close-by populations, and reaching from the Gaspé Peninsula to Key West and to other attractions on the Gulf of Mexico, would in the United States cost no more than the Florida canal; would give employment to skilled and unskilled labor in 17 states instead of one; would serve to protect the mountain forests and streams from private spoliation and restore many of them to their original charm; and, socially speaking, would provide the public with a safe, convenient, and inspiring means of movement. Utility and pleasure thereby would be sanely served in these days of increased leisure."

In conclusion, Colonel Wilgus expressed the hope that the proponents of the Florida Ship Canal, as well as those of the projects mentioned by Professor Riggs, would draw attention "to any errors of fact into which unintentionally we may have fallen, and to any reasoning that they may care to offer in rebuttal of these views."

"What we want is the truth, in order that we as engineers may properly advise our fellow citizens unexperienced in such matters. Thus may we have ground for hope that the hazards of uneconomic public-works construction in the future will be avoided or at least lessened. In that cause there can be no higher call to public duty."

Engineering-Economics and Public Opinion

MANY ill-conceived and unwarranted public and semipublic works have been undertaken by the federal administration since the beginning of the depression, said Daniel W. Mead, Honorary Member and Past-President of the Society, consulting engineer of Madison, Wis., and the best way to avoid repetition in the future is to develop public opinion to the point where such projects will be required to be based on thorough investigation, sound judgment, and sound economics.

The record of government in industry is not a satisfactory record and warrants no further extension. Among the fiascos of the past may be mentioned government control of railroads during the World War, the government-owned railroad in Alaska, government ownership of railroads in Canada, the economic record of federal irrigation projects since 1902, and that of the Inland Waterways Corporation since its organization. More recent unsatisfactory records are those of the Resettlement Administration and the federal housing projects.

The further entrance of government into the hydroelectric power field is an immediate danger. Among the ventures already entered upon are TVA, the Grand Coulee project, and the Passamaquoddy project (now sleeping, but not forgotten). A bill now before Congress (S. 2555), if it becomes law, will divide the United States into seven districts, in each of which an authority will be established essentially similar to TVA. This will practically place all future hydraulic-power development under federal ownership and operation, will probably involve auxiliary power development, and may involve federal navigation and flood protection as well as many or all private industries. This bill illustrates a policy which involves a direct attack upon the liberty of the American people, on individual freedom, and on industrial and professional independence.

The extravagance of the federal administration's policies is evident also in other directions. Hundreds of millions of dollars have been wasted on navigation projects of practically no economic value, such as the Fort Peck Reservoir and the 9-ft channel in the Upper Mississippi. Other vast sums have been spent by NRA, CWA, FERA, and WPA. PWA has been the most satisfactory activity attempted by the administration to care for the unemployed, but even here the principle of federal grants was a serious mistake, resulting in an unfair distribution of benefits and taxes.

Turning next to the "unified" development by TVA of the valley of the Tennessee River for navigation, flood relief, and power development, Dr. Mead pointed out that power development, which can legally be undertaken by the federal government only if incidental to navigation, is undoubtedly the primary objective of TVA. Power development is also to constitute a "yardstick" for measuring the cost of generating power for comparison with privately owned power utilities, and in this connection Dr. Mead quoted Dr. Arthur E. Morgan, M. Am. Soc. C.E., chairman of TVA, who wrote that "in case public power is used as a 'yardstick' or as a measure of what the private power industry should charge for its services, then it is imperative that records and accounts be honest and fair and open and that there be no hidden element of subsidy. . . . Take away those characteristics and the supposed comparison may becloud the issue rather than clarify it."

But it is fair, said Dr. Mead, to ask how the above specifications were carried into practice. On the basis of estimates of cost, including no allowance for interest during construction, for carrying charges, or for contingencies, TVA finds that its estimated income will be sufficient to pay the entire cost of the project in 50 years, without interest. But interest is as real an expense as cost of construction, operation, or maintenance.

Again, this income estimate is calculated as 4 mills per kwhr on 100 per cent of the estimated continuous capacity, whereas it appears that the annual returns if and when markets are found for the entire output cannot average as much as 3 mills per kwhr. On this basis the project would require about 125 years—without interest—to pay for itself. Furthermore, if TVA realizes 80 per cent output of continuous efficiency, instead of 100 per cent, it will be accomplishing more than could normally be expected.

The total estimated cost for the 11 dams and power plants given by TVA as of March 1936 was $479,150,000. Now if $90,000,000 of this amount be allowed as the value of navigation works, and $30,000,000 for flood protection—both liberal estimates—$359,150,000 will still remain as the total cost of power installations. This is more than $2\frac{1}{2}$ times the estimate of TVA for power house and equipment ($135,450,000), without any allowance for interest during construction, carrying charges, taxes, cost of transmission, etc. If there is any honest and intelligent defense for the $500,000,000 now apparently being wasted in the Tennessee Valley, said Dr. Mead, it should certainly be made manifest.

The Passamaquoddy project is only slightly more absurd than that of TVA, although the latter greatly exceeds it in cost. It compares on equal terms with the Grand Coulee project, by which it is proposed to develop not only an enormous amount of power for which there can be no market for years to come, but also to irrigate more than a million acres of land, largely in private ownership, for which there will be no demand within a still longer period.

The engineering features of TVA, of navigation and other works done under the U. S. Engineers Corps, of the reclamation projects, and of other current projects, said Dr. Mead, are in general well designed and well constructed, but sound engineering cannot make an uneconomic project an economic success.

Dr. Mead emphasized the importance of correcting the erroneous ideas of the public concerning the cause of floods, and decried public faith in flood control by means of a few small reservoirs at the headwaters of streams and a few small dams to prevent erosion, and by planting forests. With frozen or saturated soils and the downpour of maximum flood-producing rainfalls, he said that "such preventatives of flood runoff are only as effective as foot prints in a field."

In closing, Dr. Mead reminded the audience that the members of various engineering societies in Chicago recently voted to subject government public-works projects to critical examination by competent members and to publish the findings, and urged that similar action be taken by every engineering society in America.

Economic Advantages of Orderly Planning

CONTRARY to the general impression that the past few years have witnessed substantially increased activity in public-works construction, the fact is that the country's public-works program as a whole was a full year behind schedule by the end of 1935. This is only one of the conditions which would have been avoided by the orderly planning of public works, according to Frederic H. Fay, M. Am. Soc. C.E., consulting engineer, of Fay, Spofford and Thorndike, Boston, Mass.

The attempt made during the recent depression to stimulate business and alleviate unemployment by accelerating and expanding public-works construction was the first large-scale effort ever made in this country towards that end. Although the attempt was measurably successful, the anticipated degree of stimulation was not attained, largely on account of the lack of advance planning. The duty of guiding and educating the public on the need for such orderly planning falls chiefly upon the engineering profession. This is because of the responsibilities of the engineer in the field of economics. But before attempting to arrive at the basic principles for a controlled public-works policy, it will be helpful to review construction statistics since 1925.

Sagamore Bridge Over the Cape Cod Canal

The Canal Is an Excellent Example of Cooperative Long-Range Planning by U. S. War Department and Massachusetts Department of Public Works

According to Department of Commerce estimates, the total volume of public and private construction in the United States in the five-year period from 1925 to 1929, inclusive, averaged approximately $12,000,000,000 annually. This figure is roughly one-sixth of the average value for total annual national income for the same period. In 1933, however, when construction had reached its lowest level ($3,580,000,000), it represented only about one-twelfth of the total national income for that year.

The distribution of public-works expenditures as among the national government, state governments, and political subdivisions has been investigated both by the Federal Employment Stabilization Board and by the Department of Commerce. In the pre-depression years of 1925 to 1929, inclusive, the average total of annual public-works expenditures was $2,828,000,000. Of this amount, cities contributed about 48 per cent, counties 26, state governments 17, and the federal government 9 per cent. In the depression period of 1930 to 1935, according to recent estimates, public-works expenditures showed a net shrinkage of $3,000,000,000 for the six years. (In other words, at the end of 1935, the country's public-works program was a full year behind schedule.) In 1935, on the other hand, although the total public-works expenditures totaled $2,030,000,000, the proportions were entirely different—cities contributed 27 per cent, counties 6, states 17, and the federal government 50 per cent.

Quoting William Stanley Parker's article, "Federal Versus Local Public Works" (*The Architectural Record* for May 1937), "In the 'normal' preceding period federal expenditures had been about one-twelfth of the total [public-works expenditures]. Now it is found to be one-half. . . . For every dollar the federal government increased its expenditures in order to prime the pump, the local governments reduced their expenditures by three dollars; and even after the 1933 relief program developed, the local reduction was more than twice the federal increase."

By the Employment Stabilization Act of 1931 the federal government required federal departments to "prepare a six-year advance plan with estimates showing projects allotted to each year," to be kept up to date by annual revision and extension. A second important feature recognized the need for cooperation in advance planning between the federal government and state and municipal governments. The Federal Employment Stabilization Board, furthermore, compiled the first reliable figures on construction expenditures in the post-War period, and this was of great assistance to PWA in allocating funds. When the National Industrial Recovery Act of 1933 was passed, the Federal Emergency Administration of Public Works took over some of the functions of the Stabilization Board, but the latter continued to operate as an office of the Department of Commerce.

Controlled public works have not yet been given a fair trial, as our public-works construction program has been carried out under the pressure of an emergency and without careful advance planning. Among the basic principles of such a controlled public-works policy we may note that long-range advance planning and budgeting, and full participation by state and local governments are both indispensable for success. The financing of public-works construction during depressions may be accomplished either by drawing upon reserves which have been previously accumulated or by long- or short-term borrowing. Short-term borrowing is generally favored, and advance planning should devise a means to raise legal limits on the borrowing capacity of municipal subdivisions where necessary during emergencies.

Public-works construction, even when expanded, should give direct employment only to those workers normally in the construction field, as it is estimated that for every worker employed directly there are one or two in private industry employed indirectly in the manufacture and transportation of construction materials. If public utilities should join with public works in stabilizing their construction programs these two would account for more than half of all construction activity in the country, but such cooperation is not possible under existing taxation laws.

Reviewing the recent extension of federal aid to non-federal construction work, Mr. Fay emphasized the importance of the establishment by PWA in 1933 of the National Planning Board, an advisory body to which was assigned the preparation of the comprehensive program required by the National Industrial Recovery Act of 1933. In the summer of that year there were some 700 municipal planning boards cooperating with the National Planning Board, but state and regional planning agencies were almost non-existent. Today however, there are state planning boards in 45 of the 48 states (of which 36 are permanent bodies) and a number of regional planning commissions as well.

In closing, Mr. Fay pointed out that advance-planning and coordination in public-works construction can well be secured through some form of non-political planning agency acting independently of other government departments, free from all administrative responsibility for the carrying out of projects, and one in which a substantial proportion of its members, at least, shall be appointed in rotation for fairly long terms in order to secure continuity of policy. Such membership would present an opportunity for engineers, architects, planners, economists, business men, and civic leaders of highest standing to render valuable service to their respective communities.

Land Registration and Plane Coordinates in Massachusetts

Title Certification Aided by Use of Rectangular Coordinate System

MASSACHUSETTS, in view of its improved method of land registration based on judicial determination of title to real property, is in an unusually good position to benefit from the advantages of a state-wide system of rectangular coordinates. Two papers on this subject, delivered on October 7, 1937, before the Surveying and Mapping Division at the Fall Meeting of the Society, are summarized herewith.

In the first article, Clarence B. Humphrey describes the operation of the Land Court, provided for by the Land Registration Act of 1898, in issuing by decree certificates of title for land. All subsequent transfers must then be by certificate, giving clear title to the grantee as coming from the commonwealth, from which in theory all titles derive.

An account of the establishment of the plane-coordinate system in Massachusetts through a work-relief undertaking is given by Elmer C. Houdlette. In addition to completing the large amount of work involved in that project, the Massachusetts Geodetic Survey performed many other tasks, including the collection by eye-witnesses of authentic high-water data in Massachusetts during the New England floods of March 1936.

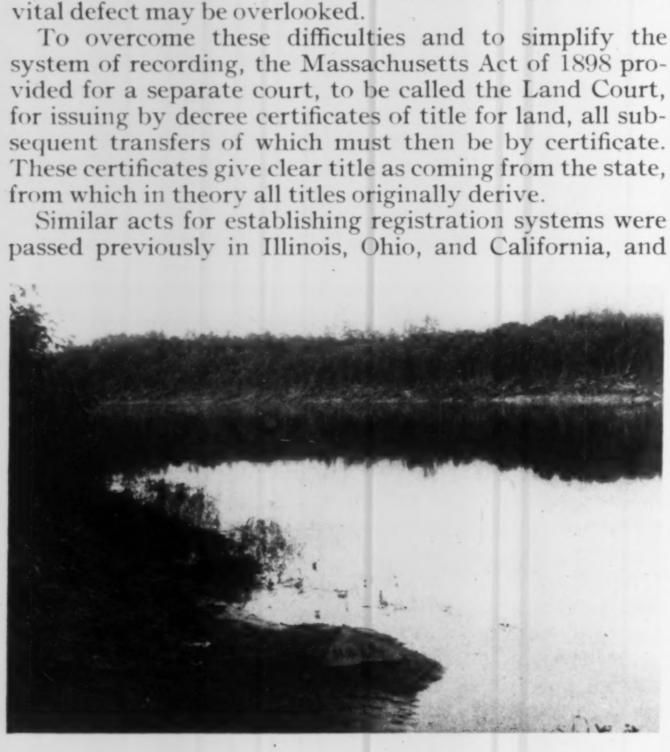
Land Registration in Massachusetts

In an informative paper on land registration in Massachusetts, Clarence B. Humphrey, engineer for the Massachusetts Land Court, outlined briefly the development in that commonwealth of two different systems for recording land titles and encumbrances.

The present system of land registration dates only from 1898. Previous to that time, deeds were recorded in the way customary in most of the other states, and title passed upon delivery of the deed, before it was recorded. There are certain disadvantages to this method, however. An obvious one is the fact that although examination and reexamination of title (made by every grantee) must go back to the original grant, nevertheless there is a considerable possibility that some vital defect may be overlooked.

To overcome these difficulties and to simplify the system of recording, the Massachusetts Act of 1898 provided for a separate court, to be called the Land Court, for issuing by decree certificates of title for land, all subsequent transfers of which must then be by certificate. These certificates give clear title as coming from the state, from which in theory all titles originally derive.

Similar acts for establishing registration systems were passed previously in Illinois, Ohio, and California, and subsequently in Colorado, Minnesota, New York, North Carolina, Oregon, Washington, Utah, Virginia, North Dakota, South Dakota, Georgia, Hawaii, and the Philippine Islands.



Monument on the Massachusetts–New Hampshire Line Between the Towns of Dracut and Pelham

The Land Court, with a judge, two associate judges, and a recorder, is situated in Boston and has state-wide jurisdiction. In addition, the registers of deeds, of whom there are 21 distributed throughout the state, act as assistant recorders. In order to register a title, a petition and a plan are filed with the recorder, together with the statutory fee. The petition describes the land, gives all known encumbrances and adverse claimants, and the names and addresses of all adjoining owners. It is accompanied by an assessor's certificate verifying the adjoining owners. The plan must be made from an actual ground survey. At the same time that the petition, plan, and any appurtenant papers are filed, a notice thereof is filed in the registry of deeds.

The petition is next referred to a court examiner (an attorney appointed by the court), who is given two weeks to report on the state of the title. After this report has been filed, notice is given to all parties in interest by publication once each week for three successive weeks in a newspaper where the land lies. It is expressly provided by the description in the notice "to all whom it may concern" that all the world is made a party defendant and is included by default. The return day of the notice must be not less than 20 nor more than 60 days from the date of issue, and within 7 days the recorder sends an attested copy of the notice by registered mail to each person named therein. An attested copy is also posted on the land itself, and such further notices are given as the Land Court may order.

If on the return day answers have been filed objecting to the petitioner's claim, then the matter is set down for a formal hearing. If the objections are not disposed of in court by agreement, stipulation, or withdrawal, the case is heard and a decision filed by the judge. This decision is final on all matters of fact, but questions of law may be taken direct to the Supreme Judicial Court within 20 days after the decision is filed. When remanded to the Land Court, an order for decree is entered as in an uncontested case. A percentage of the fees charged the petitioner in these proceedings is invested in an assurance fund which may be used to pay out in case a person has been deprived of land or interest therein by negligence on the part of an officer under the

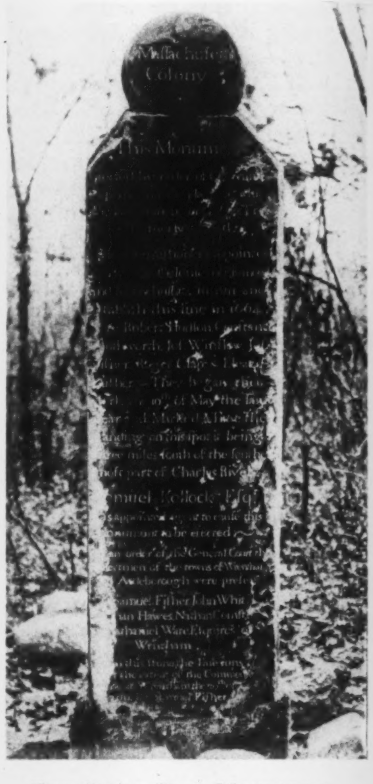
Bound on the West Bank of the Connecticut River, Marking the Intersection of the Massachusetts, New Hampshire, and Vermont State Lines

Land Registration Act. But the important thing is that any title obtained under a decree of the Land Court is indefeasible.

While the Land Registration Act does not provide for an engineer, an engineering department was early established as an adjunct to the recorder's department. Instructions as to surveys were issued to acquaint engineers with court requirements and to standardize court surveys. Among other requirements, a computation sheet must accompany the plan, showing traverses with computed latitudes and departures and such additional data as may be necessary for the computation of rectangular coordinates. This plan is filed with the petition and used throughout the case.

The final decree and approved plan prepared by the Court engineer are sent to the assistant recorder for the district within which the land is situated, who transcribes the decree into the registration book. This entry constitutes the original certificate of title and is accompanied by the plan. The assistant recorder then makes an exact copy of the original, and this is delivered to the owner as his duplicate certificate. On one side of this form appear the owner's name and a description of the land, and on the other side provision is made for entering all subsequent memoranda of encumbrances. In dealing with this land thereafter, any paper creating an encumbrance is filed in the registry and entered on the certificate. If the land is transferred, the certificate is canceled and a new one issued to the grantee, carrying forward all encumbrances of record. All original papers and documents are kept permanently in the files and are not returned as was the case under the earlier system of registration.

From the beginning it was the aim to have all Land Court surveys made so that coordinate values could be computed relative to an assumed origin which might be one corner of the survey. To this end local engineers are furnished with calculations for all reductions from geodetic values to plane coordinates, generally before they begin a given survey. The need for key maps to plot the location of registered land parcels was also early recognized, and for this purpose commercial atlases, standard base maps (cadastral plans) based on the geodetic control system and the U. S. Geological Survey's topographical sheets for the state, and early plane-table surveys have proved helpful.



The Angle Tree Monument, Erected in 1790

This Stone Marks the Intersection of the Massachusetts–New Hampshire–Vermont State Lines Between North Attleboro and Plainville

Subdivision plans constitute still another type of plan which owners are required to file with the Land Court when any tract of registered land is subdivided. New certificates are then issued, by court order except when the decree plan shows numbered parcels or parcels and ways, when a court order is not necessary. The subdivision plan work, which is an important function of the court, is handled exclusively in the engineering department. It is in dealing with such work that the engineer is brought to a full realization of the value of a coordinate system.

Mr. Humphrey concluded his paper by emphasizing that while the Land Court makes titles indefeasible and determines boundaries, a state-wide coordinate system would salve the sensibilities of adjoining owners whose disputes arise from a misinterpretation of the law controlling boundaries.

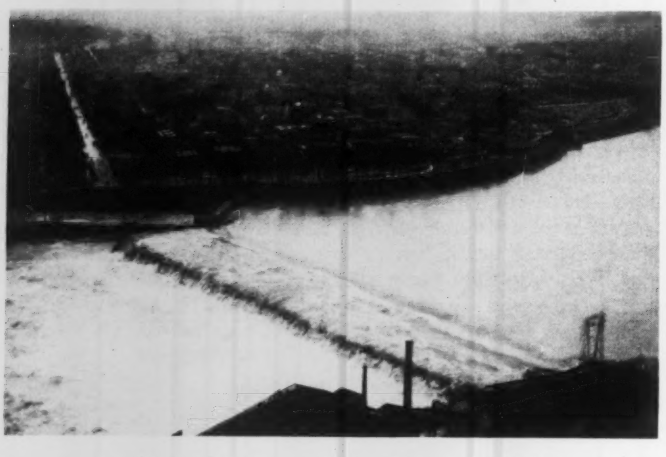
Establishing Massachusetts Plane Coordinates

Before beginning to outline the work of the Massachusetts Geodetic Survey, established in November 1933 as a CWA project, Elmer C. Houdlette, director of the Survey and engineer in the Massachusetts Department of Public Works, described in some detail the progress from early times of map construction in that state.

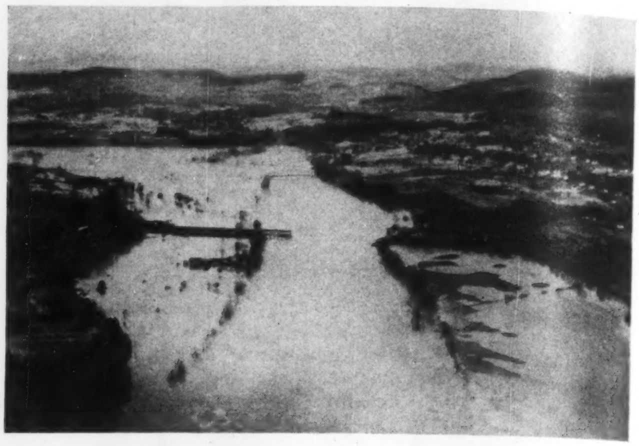
The Lambert conformal conic projection was used as a basis for establishing the Massachusetts plane–coordinate system. The meridian of 71°30′, passing through the state just east of its center, was arbitrarily assigned an X-coordinate value of 600,000 ft (placing the origin west of the entire state), and the parallel of 41°0′ (passing south of the entire state) was assigned a Y-coordinate value of zero.

The project was subjected to the uncertainties and restrictions of work-relief undertakings, but nevertheless good progress was made. One of the first requests for the services of the Survey (originally named the Massachusetts Local Control Survey) came from the Department of Conservation, which in the fall of 1934 asked that the "tying-in" of its fire towers with triangulation stations be completed, and that coordinates be computed for all such towers. At about the same time the Massachusetts Land Court requested coordinate figures for all of the triangulation stations on Martha's Vineyard and Nantucket.

At the beginning of the Survey's work, it was also necessary to transfer to the adjusted 1927 North American Datum the geographic positions of all but 17 of the established triangulation stations in the state, as the others had been referred to the North American Datum. Despite these and other problems, by the end of 1934 the Survey had completed 585 miles of traverse, including 1,170 monumented stations and 343 miles computed with an error of closure of 1:18,400; and 304 miles of first- and second-order levels, including the establishment of 679 benchmarks.



Dam at Holyoke, Mass., on March 21, 1936



View of Northfield, Mass., on March 21, 1936

FLOOD SCENES ON THE CONNECTICUT, ILLUSTRATING HIGH-WATER LEVELS RECORDED BY THE MASSACHUSETTS GEODETIC SURVEY

In June 1935, the Survey published the first book of information gathered in its activities—*Leveling in Massachusetts.* A second volume was then published, entitled *Computations of Spherical and Grid Coordinates, with Tables.* Later in the year a third work was issued. This was a preliminary volume entitled *Stream-Gaging Stations in Massachusetts,* and included data on 26 stations.

During 1935, also, the Survey started preparing maps for each city and town in the state, showing the location of all traverse and triangulation stations and benchmarks. In October of that year the Survey was requested by the Department of Public Health and various municipal water companies to establish benchmarks, determine the heights of high and low water, the crests of dams and spillways, and establish the elevation of standpipes and of the ground-water level in driven wells on a common mean-sea-level basis. During the same year requests for control were also received from 16 cities and towns, and from the newly established national guard camp at Bourne. By the end of the year 1,618 miles of first- and second-order levels had been adjusted, and 1,275 miles of traverse completed in the field with an average error of closure of 1:23,100.

In March 1936, the Survey was called upon for a task never before undertaken, namely, the collection by specially directed and specially equipped eye-witnesses of authentic high-water data during the climax of the flood catastrophe. A systematic series of benchmarks at bridges and dams along the principal rivers had been partially executed prior to the flood. On March 19, some 200 men—the full personnel of all field parties—were assigned to the duties of placing suitable marks, and recording high water at the time of day the observer was at the site. This work was continued until the extreme flood stage had passed.

The data gathered in this way were plotted on town maps and later published in one of the significant books issued by the Survey during the year—*High-Water Data: Flood of March 1936.* In April another book was published entitled *Status of Land Surveying in Eastern Massachusetts.* Still another report, *Technical Procedure for Geodetic Surveys,* was released in May, and this was followed by a re-issue of *Bench Marks in Massachusetts,* published in three volumes containing descriptions and elevations of over 2,300 benchmarks.

During the fall of 1936 magnetic declinations were determined at 70 stations for the U. S. Coast and Geodetic Survey. Early in 1937 the same agency asked the Survey to complete two first-order arcs of triangulation across the state to tie in all traverses completed to date. In June 1937, the Survey published a volume entitled *Plane Coordinates of Minute Intersections of Meridians and Parallels of Latitude Based on the Massachusetts State System.* By July 31, 1937, the Survey had completed 2,126 miles of traverse, including 3,928 traverse stations, with an average error of closure of 1:28,000; established 338 triangulation stations; run 4,647 miles of levels and established 6,203 benchmarks, including first- and second-order; established 66 magnetic stations and abstracted 61; and completed 341 city and town maps.

The usefulness of the plane–coordinate system established for Massachusetts is evident from the fact that each surveyor is provided with the plane coordinates of the monuments nearest the beginning and end of his proposed survey, together with the plane bearings to their respective azimuth marks. By tying in his survey with these monuments, he obtains a check on all his work, and his survey is also controlled and permanent.

In concluding his paper, Mr. Houdlette emphasized the fact that faithful use of the information available at each of the horizontal control stations will eliminate for all time multiplicity of origins, over-supply of level-datum planes, and varied waste of land surveys, and will in addition contribute to an enlarged network of fixed points whose permanence of location is assured. But since the value of the rectangular system of plane coordinates to future land surveys will be in proportion to the use made of it, the towns and small communities should take the initiative in requiring surveys to be tied to the system and in maintaining and extending it where necessary.

To date the Massachusetts Geodetic Survey has issued 18 publications dealing with horizontal and vertical control. Requests for these publications have been received from 42 states, 5 foreign countries, 47 colleges and technical schools, 94 governmental agencies, 62 engineering concerns, 30 industrial concerns, 26 libraries (Library of Congress, etc.), and 15 WPA units. Innumerable miscellaneous requests have been received from the American Geographical Society and others, and well over 90,000 copies have been distributed in all.

The Scientific Method in Earthwork

Rule-of-Thumb Procedure Yields to Application of Principles of Soil Mechanics in Foundation Problems

By GLENNON GILBOY
ASSOCIATE MEMBER AMERICAN SOCIETY OF CIVIL ENGINEERS
ASSOCIATE PROFESSOR OF SOIL MECHANICS, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASS.

EARTHWORK engineering is older than history itself, but scientific earthwork engineering is just now coming of age. Twenty-odd years ago the precepts of foundation design might have been epitomized thus: "Identify the soil; select a bearing value; make a loading test on a small area if necessary; when in doubt, use piles." Today the foundation engineer does not think of "bearing value" in the traditional sense; he takes the results of loading tests with a grain of salt; he knows that piles may in certain cases be actually detrimental. In short, he has forsaken rule-of-thumb procedure for the scientific approach made possible by soil mechanics. In the present article, Dr. Gilboy reviews the contributions of soil mechanics to the design of spread foundations, pile foundations, retaining walls, and earth dams. The paper was originally presented before the Soil Mechanics and Foundations Division at the 1937 Fall Meeting.

THE most significant contribution of modern soil mechanics is, I think, that it has brought the application of the scientific method to earthwork engineering. The importance of this idea may not be apparent at first glance, but a little study will show that the scientific method had little or no place in the scheme of things until recently. The chief faults were the use of rule-of-thumb procedures and the drawing of broad conclusions from limited evidence, both of which are contrary to the scientific approach. True, many engineers were fully aware of the shortcomings of traditional methods, and made up for them by the exercise of sound judgment, but this does not alter the basic argument, that modern research has been most useful in bringing about new habits of thought. To illustrate the point, it will be interesting to compare the generally accepted methods of twenty-odd years ago with those that are used by the soil expert of today.

SPREAD FOUNDATIONS

The concept of a definite unit bearing-value, dependent only upon the type of soil, has dominated the design of spread foundations. Experience in built-up localities indicated that certain load ranges were safe, and these values continued to be used. This procedure was not unreasonable when limited to a particular location and type of structure; the dangerous element was the generalization that the unit bearing-value concept was perfectly sound and could be applied everywhere—that it was all a question of identifying the soil and selecting a bearing value.

Today the well-informed foundation engineer does not think in terms of bearing value in the traditional sense. By no means does he toss aside the lessons of experience; but he uses them in a different way, taking into consideration not only the type of soil but also such factors as the sizes and depths of the foundation elements, the nature and use of the structure, the allowable settlement, and the effect of time. He also has many more tools at his disposal. The tub of dirty water beside the wash boring has been superseded by better methods of exploration. The uses and limitations of loading tests are more fully understood, and what appeared to be contradictions have been found to be different aspects of the same pattern. If a stratum of questionable material is encountered, compression tests and stress analyses can be used to estimate its probable behavior.

Now that these things are common knowledge, it is difficult to realize how deeply ingrained the bearing-capacity idea became—how, for example, a well-known construction firm could have sent Dr. Terzaghi, shortly after his arrival at the Massachusetts Institute of Technology, a cigar-box full of loose sand and gravel, with an earnest request for an opinion on its bearing capacity. Yet the scientific concepts which he proposed have taken a long time to sink in.

Even such relatively simple ideas as the effect of restraint around a footing buried in sand were not immediately grasped. An illustration of this occurred in connection with a large structure on a sand foundation, for which I once made a series of loading tests on behalf of the contractor. The tests, which were all made on the surface, showed settlements within the allowable limits, so that the structure, which was to have a buried foundation, could be expected to undergo very little deformation. The owners, however, were not satisfied, on the ground that the bearing capacity at the foundation level was still unknown. They then proceeded to sink pits to the foundation level to get this information. A concrete block was cast in the bottom of each pit, and loaded. To nearly everyone's amazement, the settlements were extremely small. The bearing capacity of the foundation was then pronounced highly satisfactory. Actually there was no marked variation in the material; the difference lay purely in the presence or absence of surrounding restraint (Fig. 1).

What was the actual bearing capacity of that sand deposit? Obviously, the question has no answer. A

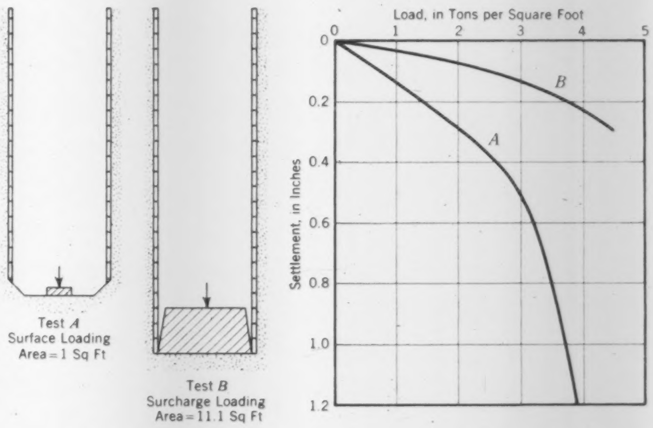


FIG. 1. EFFECTS OF SIZE OF AREA AND SURCHARGE ON BEARING CAPACITY OF SAND

storage tank resting on the surface, a power plant on a shallow mat foundation, and a factory on deeply buried individual footings, all applying the same unit load to the sand, would have undergone markedly different amounts of distortion.

Considering that sand presents the fewest complications, the futility of attempting to reduce the intricate properties of clays and mixed materials to a single sovereign value must be doubly apparent.

On the other side of the picture is the dilemma of the designing engineer. The soil experts tell him that there is no such thing as a single unit bearing-value for any soil. They admit that their investigations are still in a state of development, and that they cannot give him a final answer to all his problems. Yet he has to go ahead and design buildings. What is he to do?

First, he must recognize the limitations of traditional standards, and apply them with caution, especially in imperfectly explored fields. Second, he can collect and analyze information from his projects, especially from those that have not behaved as expected. Finally, he can foster attempts at intelligent modification of existing standards as new developments are placed on a sound basis.

One such attempt has been made in the proposed revision of the Boston building code, now before the legislature. The fundamental idea has been to specify a base bearing value, with provisions for modification depending on conditions of loading. In the case of sands, for example, the base bearing-value is low, corresponding to surface loading, and an increase is made as the foundations go deeper. Thus the important effect of lateral restraint is taken into account. Also, a reduction in bearing value is provided for small footings, in recognition of the fact that ultimate failure is a function of the size of the loaded area. Another noteworthy change is the treatment of buried clay layers. Irrespective of the individual footing loads on the overlying material, the net load over the whole area of the building, with due allowance made for reduction in weight by excavation, is limited, so that excessive stresses will not be thrown into the clay below. Every effort has been made to keep the new regulations in simple and workable form, and to hold to conservative values. In individual cases where the values seem too conservative, the owner is privileged to make detailed investigations and to request modifications on the basis of his findings.

The new code is by no means the last word. It is not even intended as a model, for it was drawn up with the conditions of Boston and vicinity in mind. But it does represent a forward step, and is an excellent illustration of the application of new habits of thought. The committee consisted of men of widely varying engineering and scientific interests, and the fact that they could agree along lines distinctly different from those in vogue twenty years ago is of great significance.

PILE FOUNDATIONS

The traditional attitude in regard to pile foundations might be summarized thus: "When in doubt, drive piles." Piles offered a reassuring relief from the problems of bearing capacity. Each pile could be watched closely during driving. The *Engineering-News* formula, compact and simple, gave the bearing value. If the worst came to the worst, loading tests on individual piles could readily be made. With this thorough knowledge of the behavior of each unit, the structure as a whole seemed reasonably safe.

Scientific investigation has changed the picture entirely. The *Engineering-News* formula, perhaps adequate in the days when most pile operations consisted of driving wooden piles with a drop-hammer, is far too simplified to give consistent results with the wide variety of pile types and equipment in use today. Furthermore, there are many types of soil in which even a perfect driving formula will give no direct indication of the static bearing capacity. The idea that the action of an individual pile under load will indicate the behavior of large groups cannot be defended; in many instances the settlement of the structure as a whole bears no relation whatever to the movement of an individual pile when tested under working load (Fig. 2). Finally, piles are not always a help. In certain cases they may be not only useless but positively detrimental.

Statements like this seem to have engendered the idea in some quarters that many soil experts have no use for piles at all. This is not correct. Piles have a definite and highly useful place in foundation engineering. The point is that they are not a panacea, and they are not a simple type of foundation. An analysis of the probable behavior of a pile foundation may be much more complicated than one involving ordinary footings, because the manner in which the piles transmit their loads to the soil is still a very uncertain feature.

A useful concept to have in mind is that if nothing but sand (or cohesionless soil in general) is present, few complications will arise in connection with piles; but if clay (or cohesive soil in general) is present, caution is imperative. The word "present" does not refer to the zone of pile-driving. No foundation exploration is worthy of the name unless it furnishes adequate information to a depth at least equal to the smaller dimension of the structure, assuming bedrock is not encountered sooner. If the exploration discloses the presence of compressible material within or below the zone of driving, a detailed study is advisable, since in all probability driving formulas and individual loading tests cannot be relied upon to tell the whole story.

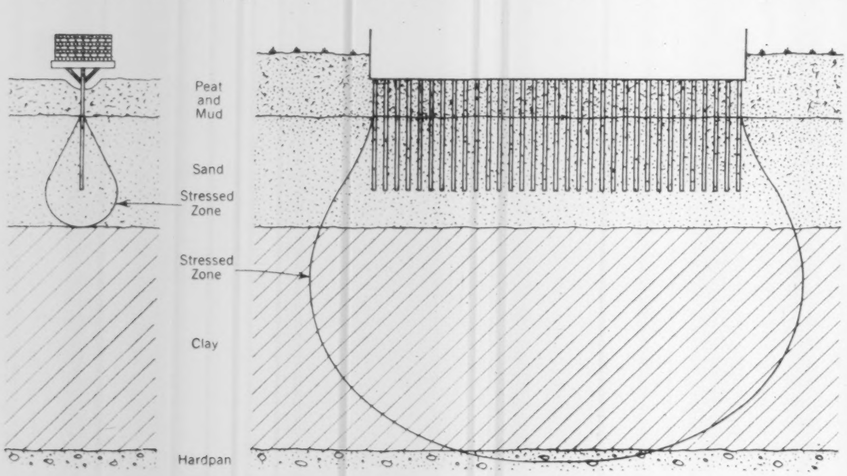


FIG. 2. THE FALLACY OF TESTING THE ACTION OF AN INDIVIDUAL PILE
In the Test at the Left, the Clay Is Practically Unloaded; Under the Complete Structure, It Is Heavily Stressed

LATERAL EARTH PRESSURE

In probably no other field connected with earthwork has presumptive reasoning been so rife as in the so-called "classical earth-pressure problem." Years ago, Rankine developed equations expressing the two limiting states of equilibrium in an idealized mass of cohesionless material of infinite extent. From that time, these equations were applied to conditions which bore little or no resemblance to the basic assumptions. Even with cohesive material their use was considered justified on the ground that cohesion was a rather unreliable factor, and if it were neglected an additional element of safety would be introduced.

Scientific investigation has led to a quite different concept. The intensity and distribution of pressure on a retaining wall vary considerably with the nature and amount of the deformation of wall and backfill, and cannot be depended upon to correspond, even approximately, to the Rankine values except under very special conditions. Furthermore, the manner in which the wall is constructed has a great influence on the pressure distribution.

It is frequently argued that too much emphasis has been placed on the effect of distortion—that if a wall is designed to resist the Rankine active pressure, it will automatically undergo the distortion necessary to reduce the pressure to a value somewhere in the neighborhood of the design figure, and hence will be safe. There is some basis for this argument; otherwise there would be many more retaining-wall failures than there have been. At the same time, it represents a kind of wishful thinking that will often be found unreliable. Frequently it is just when conditions are most critical that the soil refuses to behave in orthodox fashion.

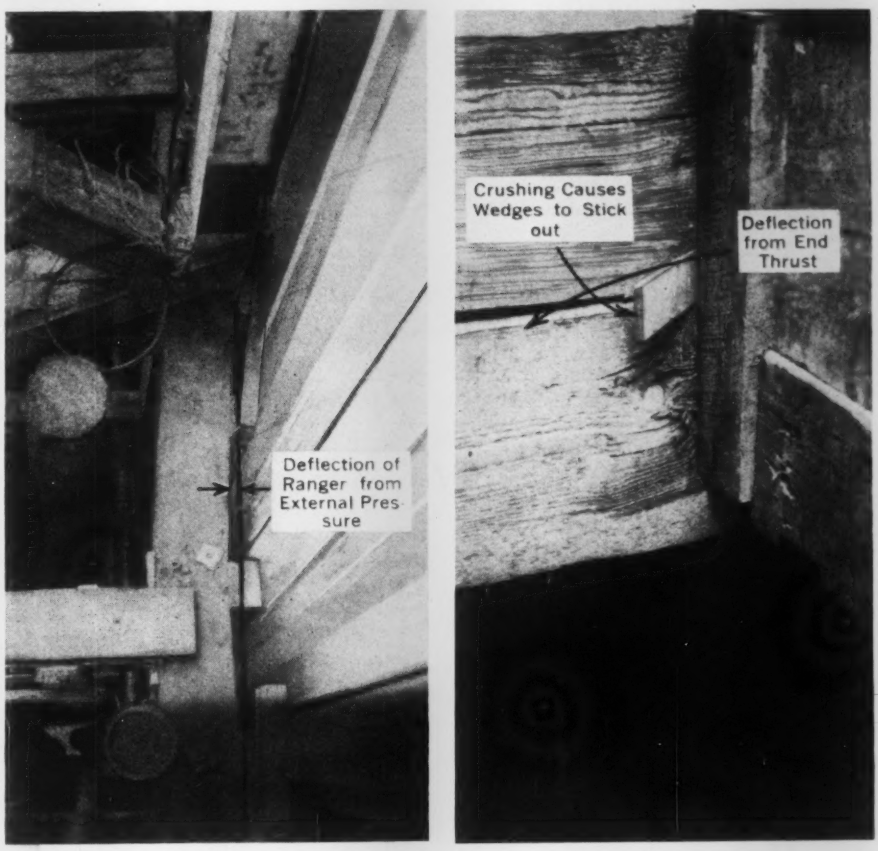

Deflection of Ranger from External Pressure
Crushing Causes Wedges to Stick out
Deflection from End Thrust

Fig. 3. Incipient Failure of Bracing in Sheet-Pile Cofferdam

Two examples will illustrate the practical aspects of the situation. The first concerns a deep cut in a sand deposit, in which the restraining elements were walls of horizontal boards between the flanges of H-columns, predriven vertically, with braces across the cut between the tops of opposing columns. As excavation proceeded, boards were added successively, working downward. In this type of construction, the earth pressure at the bottom approaches zero, a condition which is quite different from the triangular pressure distribution indicated by the Rankine and Coulomb theories. Hence the resultant is not at the lower third, but considerably above this point. The net effect in this instance was to throw loads considerably greater than had been anticipated into the upper bracing. The bracing began to buckle and the tops of the columns deflected forward. Fortunately, this first occurred at a point where the movement did little damage. The entire bracing system was strengthened, thereby narrowly averting what might easily have been a general failure of the sheeting, with disastrous consequences.

The second example concerns a steel sheet-pile cofferdam sunk in a sand deposit for the construction of a pier. It was planned to drive the piling to full depth before excavating; however, so many boulders were encountered that none of the sheets could be driven more than part way. Excavation and bracing then proceeded, and as fast as the boulders were removed, the sheets were driven down. Soon the bracing showed signs of distress (Fig. 3). Large girder-beam wales twisted and buckled, and huge timbers bowed far out of line. A careful check of the design showed that according to orthodox theory these things should not have happened. But this was not an orthodox cofferdam. The pressures on a sheet-pile wall that is driven to position before excavation are nothing like those prevailing when excavation proceeds as the sheets are driven. In the latter case, the continuous driving compacts the sand on the outside, so that the bracing members must carry loads considerably greater than those corresponding to the active pressure, for which they are usually designed.

Thus even with sand, traditional methods of estimating earth pressure do not give a complete picture. As far as cohesive materials are concerned, there is no resemblance whatever between actual pressures and those computed by classical formulas. The idea that cohesion represents an additional element of safety is especially misleading. One of the most important factors governing the pressure is the tendency of the material to swell and shrink, primarily as a result of alternate wetting and drying. When contracted, a cohesive backfill may exert little or no pressure, whereas when expanded the pressure may be far in excess of the active value, even approaching the passive.

FIELD TESTS URGED TO PROVIDE ADDITIONAL DATA

In view of the uncertainties connected with the whole problem of lateral pressure, a little scientific curiosity on the part of engineers and contractors would be of great assistance. For instance, if the braces of a cofferdam were provided with brackets so that a pair of jacks could be inserted against the wales and pumped up until the wedges were just free, a complete picture of the bracing loads could be obtained, to check against the design.

Such procedures are generally frowned upon by construction men, but the slight additional cost and time involved would be quite negligible in comparison with the value of the information obtained.

EARTH DAMS

The widespread difference of opinion in regard to earth dams is illustrated by an article by Allen Hazen, in Transactions for 1920. Mr. Hazen's experience led him to recommend the exclusion of all, or nearly all, particles smaller than 0.01 mm. from the cores of hydraulic-fill dams; whereas one of the discussers, Mr. Wiggin, suggested using an electrolyte in the sluicing water so that the colloids would flocculate and remain in the core. Other engineers joined in the controversy, and the number of different ideas on proper core composition was approximately equal to the number of participants.

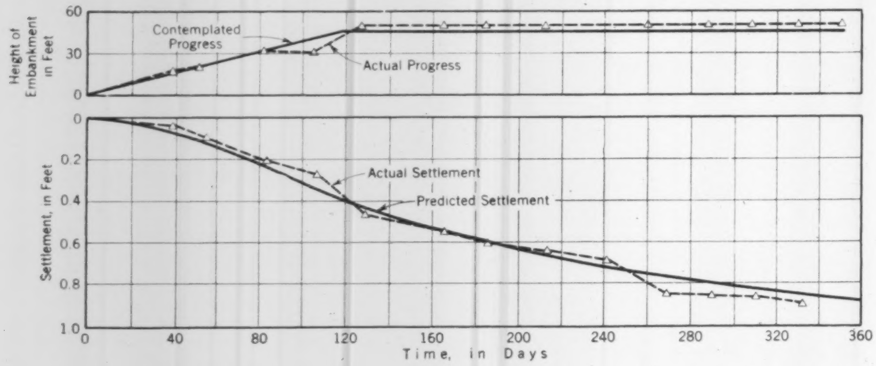


Fig. 4. This Comparison of Predicted and Observed Settlements Illustrates the Value of Scientific Forecasting

There was justification for practically all the opinions advanced. Taken together, the conclusion would be that core composition could vary within wide limits and yet result in a successful dam. And that is precisely the case. Studies of the mechanics of hydraulic fills show that core composition is not so all-important as to warrant the undue emphasis often placed upon it. Other factors, particularly the composition and strength of the shell and the geometrical characteristics of the cross-section, must be carefully considered. Hence there is no one best way to build hydraulic fills. There are an infinite number of possible designs, using an infinite number of possible materials. The main essentials are to understand the functions of the component parts, study thoroughly the various constituents, and maintain an open mind.

Studies of seepage through and under dams have clarified this phenomenon and its effect on stability. A number of misconceptions were formerly associated with this subject. For instance, it was not uncommonly believed that, in a homogeneous embankment on an impervious base, the position of the line of saturation was a function of the permeability; the tighter the dam, the steeper the drop. Actually the flow pattern is a function only of the geometrical properties of the section, and is independent of the permeability. Also, many engineers thought that the way to keep the saturation line within the body of the dam was to flatten the downstream slope. In reality, the saturation line will always come out on the slope. In order to keep it within the dam it is necessary to make the section non-homogeneous, that is, to introduce a drain of greater permeability in the neighborhood of the downstream toe.

In many quarters it was long considered necessary to make a dam as nearly watertight as possible. The concrete core-wall, an expedient of doubtful value, was an outgrowth of this idea. Recently there has been a growing tendency to recognize that all dams are bound to leak somewhat, and that some dams—especially those for flood control—can leak a tremendous amount without defeating their purpose. Thus the emphasis has shifted from the problem of stopping leakage to that of controlling it. By proper design and careful selection of materials, the seepage can be led along prepared channels provided with graded transition zones to prevent washing out of soil particles, so that the energy of flow is safely dissipated.

Important advances have been made in the design of embankments on plastic and compressible foundations. The uncertain character of these materials has been emphasized by past failures, some of a catastrophic nature; but only recently have attempts been made to analyze the problem scientifically (Fig. 4). The stress-strain relations are so complicated that the information now available can be considered only a beginning. Nevertheless, it affords a clearer concept than has hitherto existed. An interesting corollary, somewhat at variance with previous notions, is that the attainment of maximum possible compaction in an embankment is not always desirable. Too much compaction can produce excessive swelling stresses, accumulating to a point where the shearing strength of the foundation is exceeded and considerable movement results.

The importance of collecting field data on dams during construction and after completion cannot be overemphasized. Provisions for observation and measurement may appear to introduce complications, but the slight additional trouble will be repaid many times over.

CONCLUSION

Other branches of soil mechanics have produced noteworthy achievements, but those cited herein illustrate the practical usefulness of scientific study. The process is not one of tearing down, but of building up. The lessons of previous experience must not be ignored, but they should not be extended into unwarranted generalizations. No doubt standardized procedures are of considerable help, but standardization can easily be carried too far, and is particularly dangerous in a field that has been only partially explored.

In conclusion, a word of caution to the newly formed Soil Mechanics and Foundations Division. As time goes on, there will undoubtedly be some pressure on the Division to take the lead in reducing the contributions of modern research to simplified forms. To a certain extent, simplification is helpful. For example, a practicing engineer may have forgotten all about Fourier's series, so that he would have difficulty in following the details of the consolidation theory; yet a simple explanation of the consolidation phenomenon could be readily understood, and would assist him greatly in visualizing what happens when he puts up a building on an incompletely consolidated clay deposit. Activities of this type are laudable. But there should be a sharp curb on any tendency to lend the sanction of the Division and the prestige of the Society to broad standardizations, which, though different in detail from older methods, may be equally open to criticism. The motto of the Division might well be: Take nothing for granted.

Some Recent Canadian Construction

Interesting Features of New Bridge, Port Development, and Hydroelectric Plant

CANADIAN engineers provided the program for the afternoon session on the first day of the Fall Meeting at Boston, October 6, 1937. From the west coast, more than 2,500 miles away, W. G. Swan, M.E.I.C., contributed a paper on the substructure of the new highway bridge over the Fraser River at New Westminster, B.C. He described in detail the methods of construction, noting the difficulties introduced by the heavy currents, the nature of the site, and the foundation material. The east coast was represented by a paper by E. H. James, M.E.I.C., on the Port of Halifax, N.S. Here again the accent was on construction methods, with particular reference to reconstructions and additions since 1930. Concluding the program, H. G. Acres, M. Am. Soc. C.E. and M.E.I.C., discussed the Outardes Falls power development, a 65,000-hp installation now being built on the north shore of the Gulf of St. Lawrence. Emphasis is placed on unusual features of design. These papers were published in full in the "Engineering Journal" (monthly journal of the E.I.C.) in October, and are therefore summarized only briefly here.

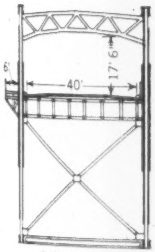
Substructure of the Fraser River Bridge

THE new Provincial Government Bridge at New Westminster, B.C., designed to carry a four-lane highway over the Fraser River, is now nearing completion. A general elevation of the structure and its approaches is given in Fig. 1.

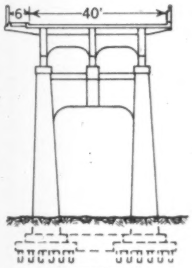
Particular interest centers about the design and construction of the substructure. Good foundation material was available only for Piers 1 and 2; the remainder of the piers, located in river sand of an indefinite depth, must rely for their support on the bearing value of the sand plus the friction on piles or caissons. Complications were introduced by the heavy current, which attains a velocity of 8½ miles per hr seaward at certain times and flows in the reverse direction at others. Further, the location of the piers was essentially determined by the position of those of an existing bridge just 200 ft upstream.

Open-caisson construction was adopted for Piers 1 to 4, while Piers 5 to 8 were founded on bearing piles and erected inside cofferdams. Complete details of this work were given by W. G. Swan, M.E.I.C., consulting engineer of Vancouver, at the Fall Meeting at Boston.

The caissons, one of which is shown in Fig. 2, were of timber construction, with a steel cutting edge and concrete walls and partitions. When towed to position, they drew 29 ft of water. At the sites, accurately located pile enclosures with one end open had been prepared to receive them. The process of grounding caused considerable scour at the upstream nose of each caisson, but it was held in check by gravel, placed by means of a sealing bucket as soon as the caisson was well grounded.



SECTION A-A



SECTION B-B

Solid pockets were provided in the caisson sections directly under the pier pylons, but to ensure more uniform compacting and bearing over the base of the caisson, the lower part of these pockets was filled with a mixture of sand and gravel, rather than with concrete. The concrete was placed by tremie. As the pipe was too long to permit plugging at the outlet, an excelsior plug was inserted by hand immediately below the hopper. The excelsior was packed loosely enough not to interfere with the flow of the charge, and the scheme worked satisfactorily.

The timber cofferdams for the caisson piers were placed in three sections. Leakage, occurring at the corner joints, was reduced by cinders fed from the outside and canvas and wedging placed on the inside.

The cofferdams for Piers 5 to 8 consisted of a single row of wooden sheet piling, 12 in. thick with a 4-in. tongue and groove, held in line by double timber waling at the low-water level and at the top of the cofferdams. On their completion, excavation was carried down to the bottom of the foundation slab level; bearing piles were driven; and a 12-ft seal of concrete was placed by tremie. After the cofferdams were unwatered, the projecting piling was cut off and a 7-ft reinforced slab was poured in the dry, bringing the seal up to the elevation of the base of the pier shaft. The remainder of the pier construction was comparatively simple. After the cofferdams had served their purpose, the timbers were driven down to slab level to provide a skirt around the bearing piles, for protection in case of unexpected scour.

Throughout the pier construction, the weight of shafts and pylons was reduced to the minimum consistent with loading requirements. Though this policy may seem to have been carried to an extreme, it is justified by the cheapness of form lumber in British Columbia.

Just after the base course of Pier 5 had been placed, an unusually heavy freshet introduced a few complications that were not on the construction program. A timber breakwater upstream broke loose and punctured and loosened the cofferdam. Flooding relieved the external pressure on the sheet piles and they broke free. Before the freshet subsided, the river bed had scoured to the bottom of the seal. However, no settlement of the pier took place.

The restoration plan included the following features:

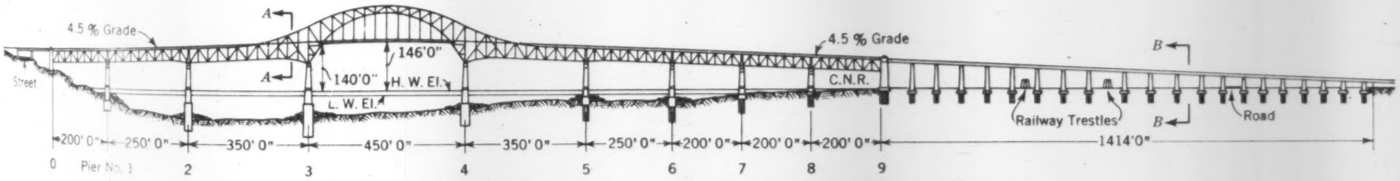
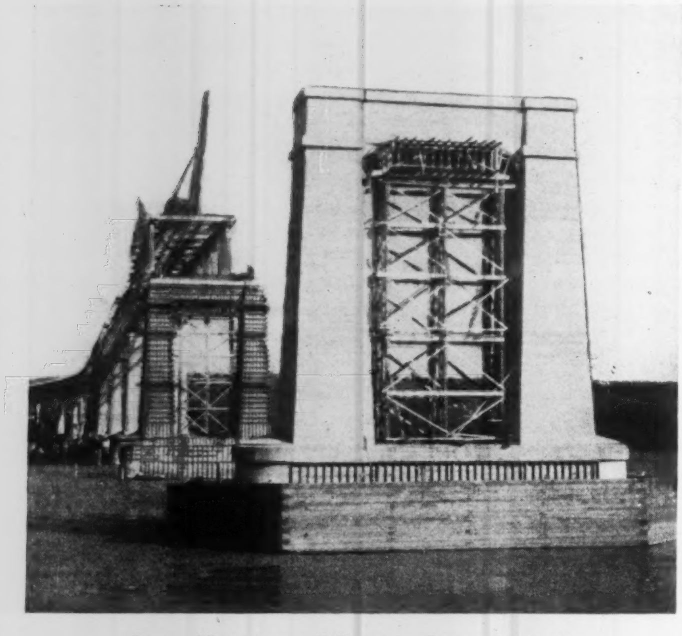


FIG. 1. GENERAL ELEVATION OF NEW BRIDGE OVER FRASER RIVER

Restoration of the bearing value of the foundation piling; provision of permanent protection against deep scour; and streamlining the new work to reduce scour. To restore the bearing value, the exposed portions of the piles were backfilled with sand and gravel, placed carefully to avoid side pressure on the piling. This filling was brought up to within two feet of the bottom of the foundation slab, after which fine sharp sand, selected to produce high frictional resistance, was jetted under the slab. An outer cofferdam of steel sheet-piling was then driven around the slab; its ends were made semicircular, for streamline effect. Within the semicircles, wooden bearing piles were driven. A total of 44 four-inch pipes were installed in the end and side areas between the cofferdam and the foundation slab, and a 5-ft layer of tremie concrete was deposited to seal them in place. Through each of the 4-in. pipes, in turn, a grout pipe was driven, and a total of 4,000 sacks of cement (in the form of grout) was forced into the foundation material. As the final step in the restoration, the space between the sheet piling and the pier shaft was brought up to foundation level by backfilling with sand and gravel, covered with a layer of 3- to 6-in. gravel to withstand displacement by the current. Similar backfilling was done outside the cofferdam, on a slope of 1 on 3, and covered with rock riprap paving to a thickness of 6 ft.



PIERS NOS. 4 AND 5 DURING CONSTRUCTION

In order to construct the pier shaft in the dry, a crib cofferdam was placed on top of the foundation slab, cement mortar being used to seal the contact. No trouble was experienced in unwatering against 14 ft of head.

The contractor's equipment for substructure construction included floating derricks and pile drivers, and a floating concrete-mixing plant and hoist tower. The mixing plant, built on a scow 40 by 123 ft in plan, contained two 1-yd mixers, storage bunkers for aggregates, and space for cement storage. A conveyor belt carried the cement to the mixer room, and sand and gravel were fed by gravity from the bunkers above. The weighing scales were balanced so that they would compensate for the listing of the scow.

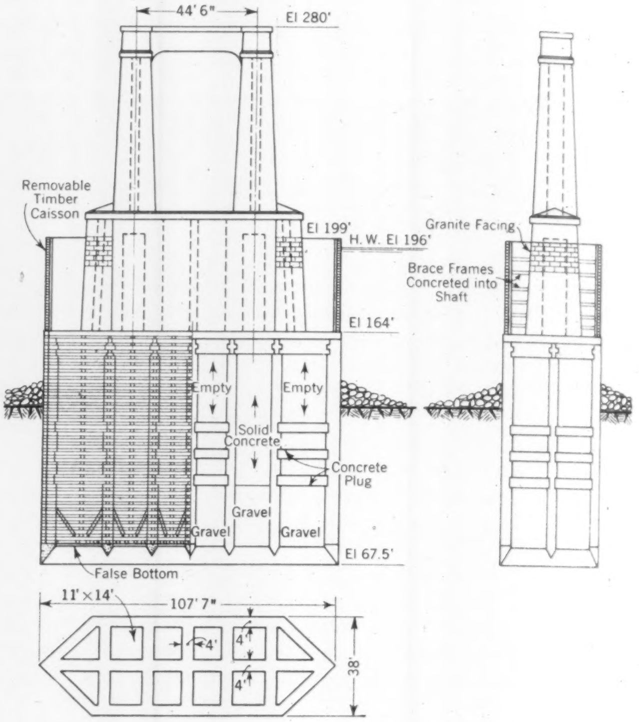
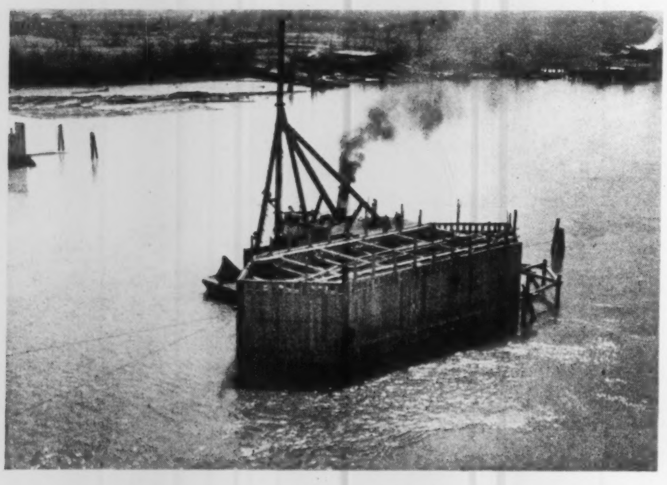
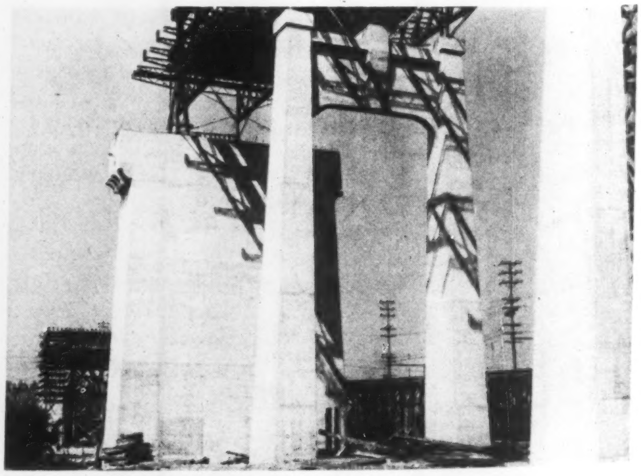


FIG. 2. PIER NO. 3, SHOWING CAISSON



NO 4 CAISSON AT SITE, JUST BEFORE GROUNDING

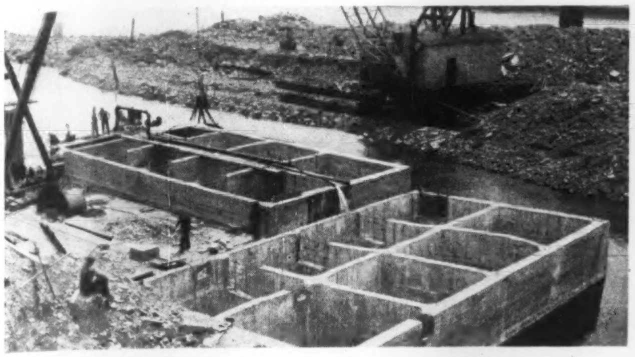


PIER NO. 9 AND END OF SOUTH APPROACH

Developments at the Port of Halifax

Halifax, N.S., is one of the principal eastern ports of Canada. It has an excellent natural harbor with ample depth of water, a tide range of less than 7 ft, practically no currents, and is free of ice throughout the year. The principal facilities are indicated in Fig. 1. The paper presented at the Fall Meeting by E. H. James, M.E.I.C., consulting engineer of Montreal, was concerned chiefly with developments and repairs made since 1930, beginning with the construction of Pier B.

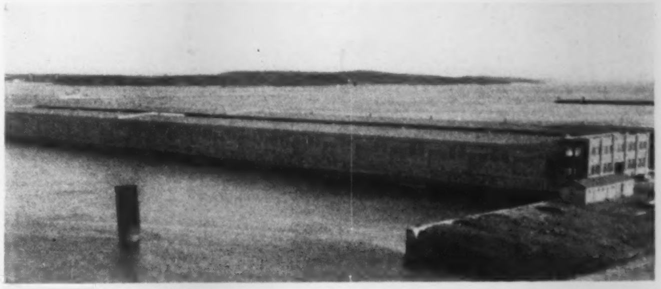
This pier, shown in an accompanying photograph, is 1,250 ft long and 300 ft wide. It consists of large concrete cribs, filled with pumped sand, a concrete superstructure wall, and a central rock-and-sand fill. The cribs, 42 to 52 ft wide, were constructed in a floating pontoon on the Tromenhauser system, and sunk in their correct locations by admitting water through siphons. They were then filled with pumped sand, and the spaces between them were closed by concrete bag work placed by divers. After the cribs had become stable, a timber waling was bolted to their front walls, shaped to smooth out inaccuracies in alinement. The superstructure wall was built out to this line, overhanging the face of the cribs, and the wall was carried down to the waling as an apron. The lower part of the central fill consists of well-consolidated rock; the upper part is of fine sand placed hydraulically.



Sinking Concrete Cribs for Fish Pier
This Structure, Built in 1934, Is Indicated in Fig. 1

The pier shed, built in 1934, is a single-story steel structure continuous on both sides of the pier and across the sea end. It is served by six railroad tracks and a truck roadway. Heated rooms are provided for perishable commodities. For fire protection a complete sprinkler system was installed, controlled by devices that admit water to the pipes only when the rate of temperature rise exceeds a given amount. This avoids the release of water, and consequent damage to stored cargo, in case of accidental breakage of a head. When these devices go into action an alarm sounds and the pipes fill, but no further action takes place unless a head goes.

In 1932 a fire destroyed the upper floor of the shed of Pier 2, just before the start of the busy winter season. Reconstruction began as soon as the building had cooled sufficiently to permit work. The original floor was a concrete slab with $1^1/_2$-in. finish placed after pouring. Examination showed that although the finish was damaged to such an extent that it had to be removed, it had protected the main slab almost perfectly. It was only necessary to cover the latter with a 2-in. asphalt paving (rolled with a 10-ton roller) to put it back in shape.



General View of Pier B

The upper story was replaced in structural steel, because the approach of winter made concreting impracticable. The old dowels for the upper floor concrete columns were left in place, bent over, and concrete pedestals were poured around them to support the new steel columns. The walls were of corrugated sheeting. Heat insulation was provided for a part of the shed by means of a transverse fire wall, a 6-in. hollow-tile wall just inside the corrugated sheeting, and insulating board on the timber deck beneath the roofing. Heating units were provided to maintain a temperature of about 35 F.

In 1934, the 730-ft section of the wharf at Richmond was constructed. This wall is of timber cribs, whose exterior faces are protected by two thicknesses of creosoted hard wood. The cribs were constructed on shipyard launchways, which made it necessary to launch them longitudinally. Because the cribs were not of constant depth from front to back, it was also necessary to partially ballast them before launching so that they would float level after leaving the ways. A system was worked out satisfactorily with a scale model, but after trouble with the first two cribs it was decided to sheath the leading pockets to provide temporary flotation for the front end when launching. This worked out satisfactorily, and the light sheeting collapsed as soon as the crib was clear of the ways, thus permitting it to float on an even keel. The cribs were ballasted sufficiently to ground on the falling tide after they reached their final position. As soon as they grounded, additional ballast was added rapidly to prevent reflotation.

The old grain galleries at Halifax were of timber, presenting a serious fire hazard. When repairs to the supporting posts became necessary, it was decided to rebuild the entire gallery system in steel. This work was done practically without interruption to the handling of grain.

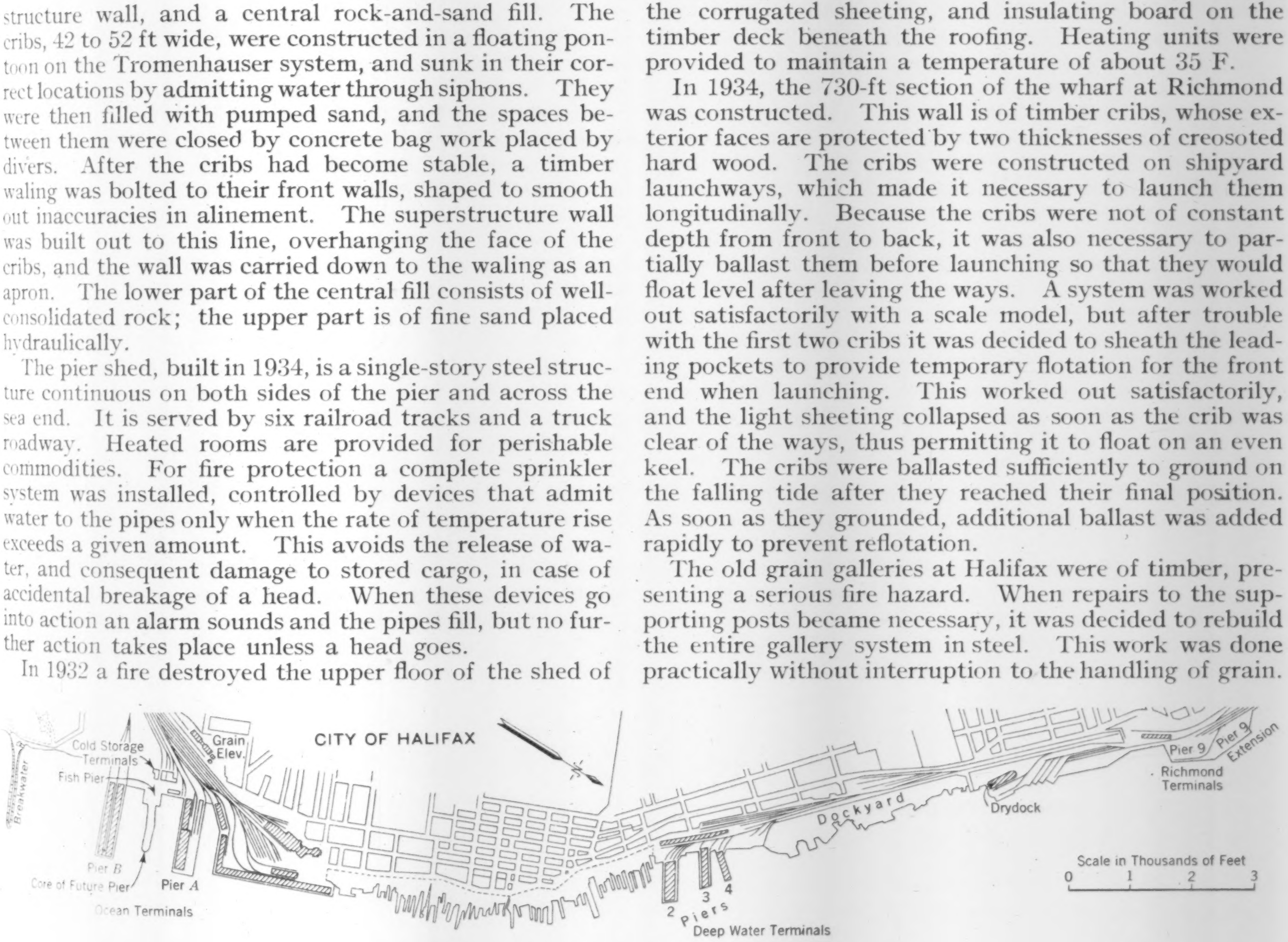
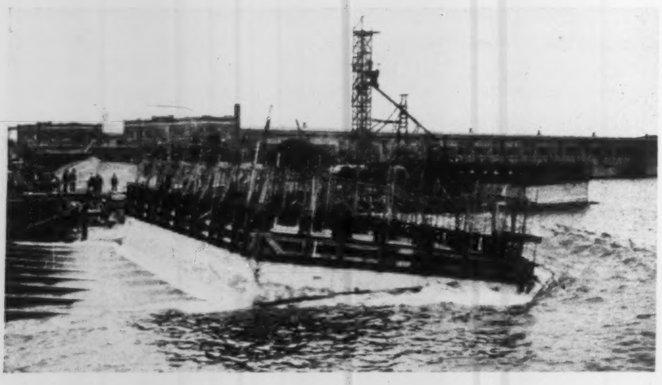


Fig. 1. Port Facilities at Halifax



LAUNCHING A CRIB FOR THE IMPERIAL OIL COMPANY PIER

On the opposite side of the harbor to that shown in Fig. 1 is a large refinery of the Imperial Oil Company. In 1934 a new pier was built there to handle oil shipments. It consists of four concrete cribs 98 ft long and 44 ft wide, each divided into 24 cells. As it was desirable to pour the concrete with the cribs in a horizontal position, the launching ways were equipped with a rocking platform on which the bottom slab and 13 ft of the walls were poured. To launch the crib, this platform was tilted over into the line of the ways by means of jackscrews. The cribs were launched with the forms in place, and completed before they were towed to position. As their height increased it was necessary to ballast them by pumping in water, in order to keep them from becoming unstable.

When all cribs were set, the superstructure wall of the pier was constructed and the enclosed area was filled with sand and gravel. A concrete slab was then placed over the entire area, except for the trench housing the pipe lines, which was equipped with a removable timber cover at the deck level. Connection between pier and shore is provided by a creosoted pile trestle carrying 14 pipe lines and a 10-ft truck roadway.

For all the projects described in this paper, Mr. James was consulting engineer either to the Harbor Commission or to the Imperial Oil Company.

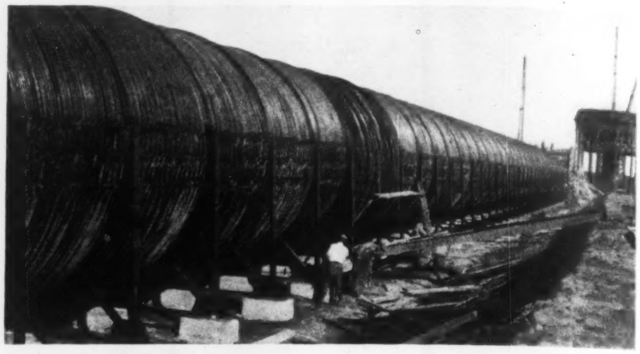
The Outardes Hydroelectric Project

On the north shore of the Gulf of St. Lawrence an entirely new industrial community, known as Baie Comeau, is rapidly taking form. This community will be supported by a newsprint mill, now under construction for an initial rated output of 320 tons per day. Because this mill is inaccessible to existing power systems, a 65,000-hp hydroelectric plant is being built about 14 miles westward of the mill site, at tidewater on the Outardes River. The design of this plant was discussed by H. G. Acres, M. Am. Soc. C.E. and M.E.I.C., consulting engineer of Niagara Falls, Ont., at the Fall Meeting of the Society.

The falls that provide the head comprise a reach of river something over a mile in length, in which the drop is about 190 ft. The minimum monthly flow will provide 39,500 hp of prime power, and with regulation immediately available upstream this will be increased to 52,100 hp, under a normal effective head of 208 ft.

Work on the project was begun in 1926 and temporarily suspended in 1932, at which time the concrete main dam and intake had been essentially completed. Operations were resumed in 1936, the remaining elements being the water connections, power house, and transmission line. The general profile shown in Fig. 1 indicates the principal features of interest to the civil engineer.

From the intake a wood-stave pipe line extends 5,960 ft to the point where the static head increases beyond the economical limit for that type of construction. There it connects with a steel pipe-line 450 ft in length, terminating in a Y-branch beneath the surge tank, and from that point twin penstocks lead to the power-house units.

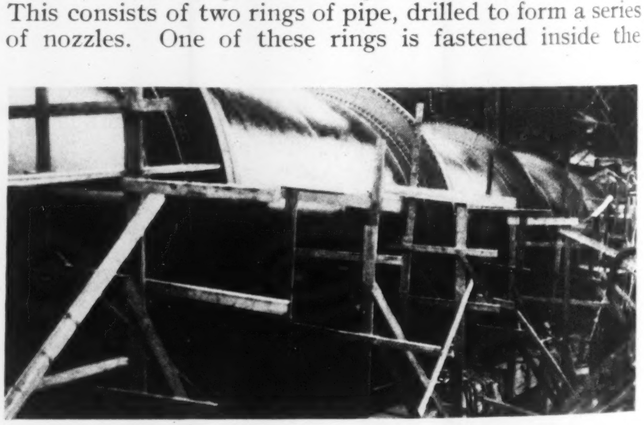


CINCHING AND SPACING BANDS ON WOOD-STAVE PIPE

The wood-stave pipe, with an inside diameter of 17 ft 6 in., is the largest of that type yet built. The staves are of special grade Douglas fir, $4\,^{11}/_{16}$ in. thick, with double tenon butt joints, tongued and grooved edges, and faces milled to the radius of the pipe. The bands are steel bars 1 in. in diameter, with malleable cast-iron shoes. Support for the pipe is provided by reinforced-concrete spread footings and structural-steel cradles spaced on 9-ft centers.

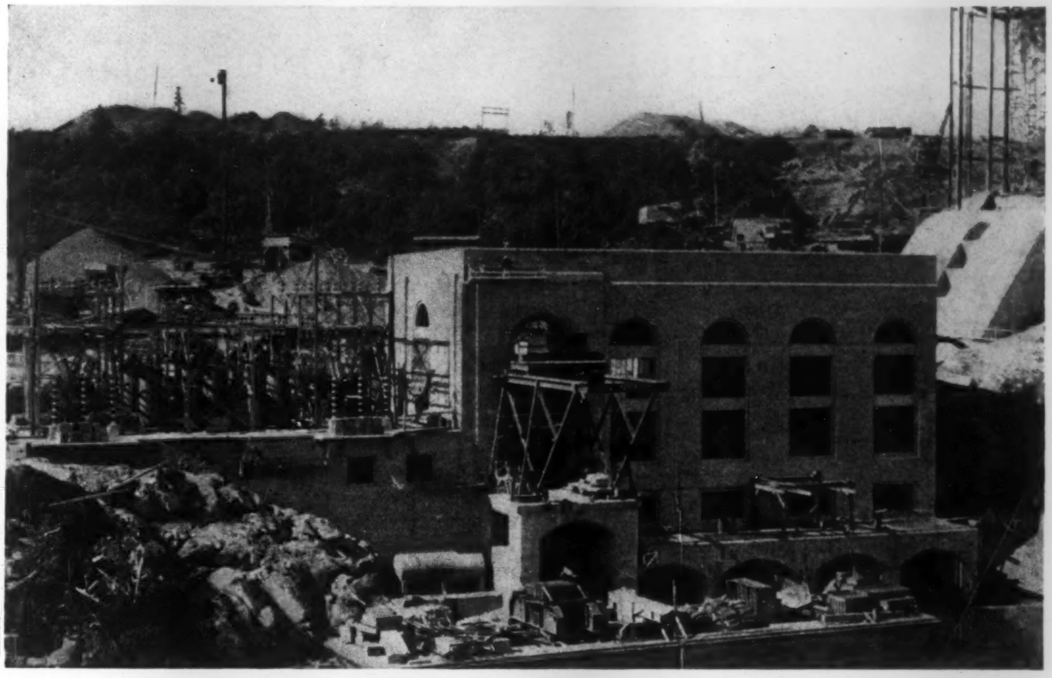
The steel pipe, 18 ft in diameter, is of welded steel plate, and ring girders 18 in. deep are provided at 22½-ft centers to relieve the bending stresses. Since with this arrangement only direct and shearing stresses govern the design of the pipe plates, metal can be used with great economy.

There is nothing unusual in the design of the differential surge tank, except for the provision made against the formation of ice. The outside riser, and the dish bottom and the top of the tank are to be insulated by a layer of rock wool with a weather-proof coating. During normal operation it is expected that this insulation, together with the more or less constant surging of the water, will suffice to prevent ice formation. However, during the first winter, when the mill load will be low, the surging cannot be safely depended upon to provide this protection. Hence an air bubbler system has been installed. This consists of two rings of pipe, drilled to form a series of nozzles. One of these rings is fastened inside the



18-FT DIAMETER STEEL PIPE, SHOWING RING GIRDERS AND STRUTS lower part of the tank bowl, and the other inside the base of the internal riser. Compressed air will be supplied from the power house under 100-lb pressure.

As for power-house installation, the total motive-power requirement of the Baie Comeau project is concentrated in one main unit, and a duplicate spare is provided. Each unit consists of a vertical-shaft turbine, with steel-plate scroll-case, turning at 180 rpm and rated at 35,300 hp under the normal net head of 208 ft. The generators are of the two-bearing type, with top-mounted thrust bearing and direct-connected exciters.



General View of Outardes Power House

Note Twin Penstocks, Concrete-Encased, Approaching Power House at an Angle from Extreme Right

The position of the power house and that of the penstocks were both fixed within narrow limits by the topography and the foundation conditions. The penstock center line, as a consequence, meets the rear wall of the power house at an angle of 34°28′. This complicated the basement layout to such an extent that it was necessary to make a $\frac{1}{4}$-in. scale model in order to visualize the valve-chamber clearances and the shape and volume of space required for piping and auxiliaries. The only other unusual feature of the power house arose from the fact that all heavy equipment had to be delivered on scows. In order to place this equipment within reach of the main hook, the erection-bay floor was extended through an opening in the front wall, and out over the tailrace piers. On this exterior platform there was erected a cantilevered steel framework supporting a motor-operated trolley hoist, by means of which loads were lifted from the scows, landed on the platform, and either trucked or skidded through the opening to a point where they could be reached by the main hook.

The transmission-line route, $13^1/_2$ miles in length, lies mainly through wet shallow muskeg with a sand bottom. The towers have a nominal spacing of 800 ft and are about 80 ft high. A graded highway between Baie Comeau and Outardes Falls, following this line as closely as possible, is now practically completed.

In conclusion, mention should be made of a rather unusual duty assigned to the spare hydro-generator at Outardes Falls. To meet the process-steam requirements of the Baie Comeau mill, three steam-producing units (including one reserve) are necessary. It was considered that the spare generator could properly supply "electric fuel" for one steam-producing unit without impairing its utility as a standby for electric power; so the steam-boiler installation at the mill is made up of two fuel-fired units and one electric unit that will draw the full load of the spare generator except when the latter is called on to perform its primary function. This electric boiler will provide, almost continuously, a little more than half the process-steam requirements; the saving in coal consumption will be considerable.

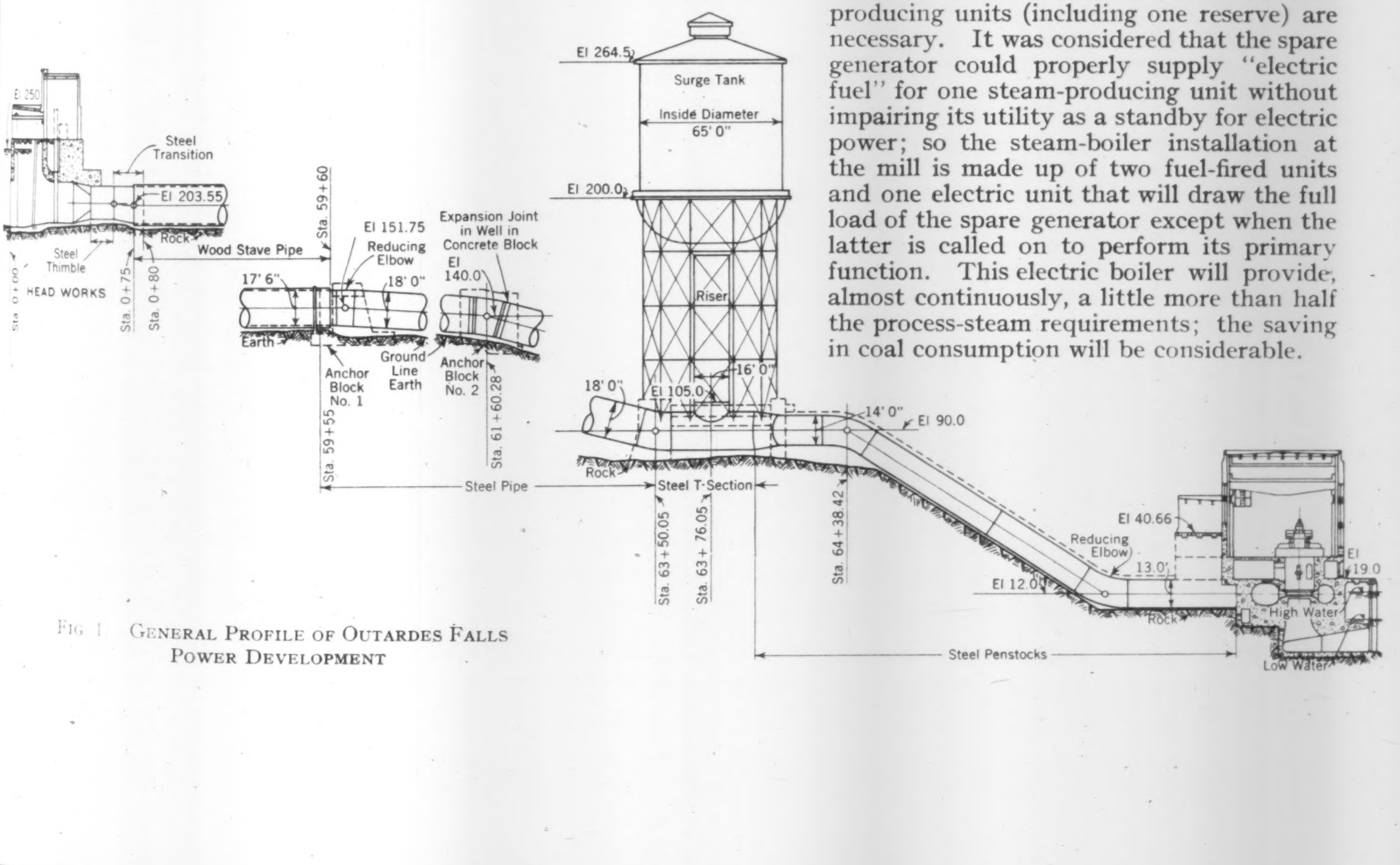

El 250
Steel Transition
El 203.55
Rock
Steel Thimble
HEAD WORKS
Sta. 0+00
Sta. 0+75
Sta. 0+80
Wood Stave Pipe
Sta. 59+60
El 151.75
Reducing Elbow
17' 6"
18' 0"
Earth
Anchor Block No. 1
Ground Line Earth
Sta. 59+55
Expansion Joint in Well in Concrete Block
El 140.0
Anchor Block No. 2
Sta. 61+60.28
Steel Pipe
El 264.5
Surge Tank
Inside Diameter 65' 0"
El 200.0
Riser
16' 0"
18' 0"
El 105.0
Rock
Steel T-Section
Sta. 63+50.05
Sta. 63+76.05
14' 0"
El 90.0
Sta. 64+38.42
El 40.66
Reducing Elbow
13.0'
El 12.0
Rock
El 19.0
High Water
Low Water
Steel Penstocks

Fig. 1 General Profile of Outardes Falls Power Development

Recent Increases in Marine-Borer Activity

Destructive Organisms Intensify Ravages in New England and Newfoundland Harbors

By William F. Clapp
Consulting Biologist, Duxbury, Mass.

Greatly stimulated by some factor, destructive marine borers, including limnoria, chelura, and teredo, have spread northward along the Atlantic coast during the past few years. In several cases where pollution of harbor water has been reduced, one unlooked-for result has been to greatly increase the number of such organisms. The significance of this invasion to constructors of wharves and bulkheads is emphasized in the accompanying article, abstracted from the paper delivered on October 7, 1937, before the Waterways Division of the Society at its Fall Meeting, which was based in turn upon marine-borer studies conducted for the New England Marine Piling Investigation Committee under the direction of A. H. Morrill, M. Am. Soc. C.E. Readers may also wish to refer to Dr. Clapp's earlier article on marine borers, published in "Civil Engineering" for February 1937.

During the past five years there has been a remarkable gradual increase in marine-borer activity along the entire North Atlantic Coast, from southern Connecticut to Newfoundland. During 1937, the rate of increase has been greatly accelerated, probably because of conditions resulting from the exceptionally mild winter and warm summer.

In Newfoundland, Nova Scotia, and New Brunswick, during the spring and summer of 1937, the attack registered by *Limnoria lignorum* in the twenty test boards being operated there has shown a twofold to tenfold increase over previous years.

LIMNORIA COUNTS RISING

It is remarkable that in the 200 or more locations where test-board studies are being conducted in New England waters, a large majority show an almost unbelievable increase in the number of limnoria. In no location has the limnoria census decreased. Furthermore, in such areas in Boston Harbor as Fort Point Channel and the Charles and Mystic rivers, boards which have never shown any limnoria attack now contain some specimens each month. The condensed table herewith (Table I) indicates the comparative increase in numbers of this destructive species.

Where the census is high, the count recorded on a standard test block is calculated from the number of individuals per square inch of surface. The rate of destruction of timber due to limnoria activity varies directly with the number of individuals present. The Mystic River station, for which observations are given in Table I, provides an excellent example of increased limnoria activity. The counts listed were all made on blocks submerged the same length of time (eight months) and at the same location and depth.

These examples are not exceptional. Comparable conditions prevail in many other harbors. The data accumulated during the period 1934–1937 indicate the probability that timber depreciation in the North Atlantic due to limnoria activity will be more rapid in the future than it has been in the past. Owners of marine timber structures should consider methods for reducing or eliminating this depreciation.

OTHER DESTRUCTIVE ORGANISMS MOVE NORTH

Chelura terebrans, a crustacean even more destructive than limnoria, was rarely found in American waters until recent years. The first recorded examples of severe destruction occurred at the Army Base in Boston in 1934 and later in other structures in the vicinity. Between 1935 and the present time, however, it has appeared in more than a dozen harbors in New England, and test boards which in previous years had failed to record any trace now register severe and continuous attack by this species in ten harbors. In northern Europe, Australia, and other countries where it is plentiful, chelura is considered much more destructive than limnoria. If it continues to spread and increase, it will become a major problem to the owners of marine properties.

The harbors where it is now found in destructive numbers include Boston, Provincetown, Nantucket, Martha's Vineyard, New Bedford, and Woods Hole in Massachusetts; Newport in Rhode Island; and Stonington, New London, and Mystic in Connecticut.

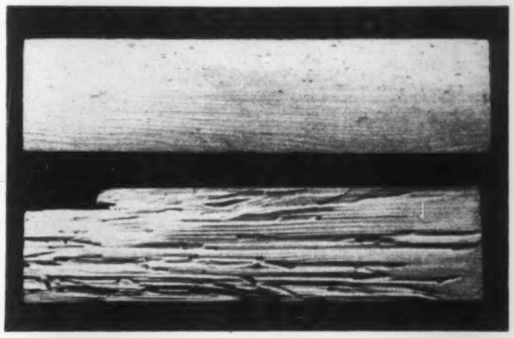
Teredo navalis has always been the most destructive marine borer in New England waters, but until recently its activities have been confined almost entirely to harbors south of Cape Cod. In the past there have been very few records of any destruction due to *Teredo navalis* north of this locality, and test boards operated in some harbors in southern Massachusetts, Rhode Island, and Connecticut have for many years failed to record any trace of this organism. Moreover, past inspections of

Table I. Limnoria Count on Test Boards Operated in the Vicinity of Boston

	In the Vicinity of Boston Navy Yard						At U.S. Army Base, Reserve Channel, Boston				In the Mystic River, Boston†		
	1922	1923	1934	1935	1936	1937	1922	1923	1934	1935	1935	1936	1937
January	..	11	...	2,000	2,000	5,000	..	0	...	75	..	0	160
February	..	6	...	2,000	2,000	4,000	..	0	...	100	..	0	175
March	..	0	...	2,000	2,000	3,000	..	0	...	300	..	2	12
April	..	0	...	100	2,000	4,500	..	0	...	1,000	0	3	250
May	..	6	60	200	2,000	4,500	..	6	...	2,000	0	3	180
June	..	6	75	100	750	3,500	..	0	1,000	2,000	0	16	2,500
July	0	30	400	100	2,500	3,500	..	0	1,000	3,000	0	65	1,000
August	2	20	800	1,000	2,500	5,000	..	0	1,000	5,000	0	230	3,500
September	0	100	1,000	1,000	2,500	5,000	..	0	2,000	5,000	20	27	...
October	0	..	1,000	1,000	4,500	...	0	..	5,000	5 000	20	100	...
November	1	..	1,000	1,000	4,500	...	0	..	...	*	20	180	...
December	0	..	2,000	1,000	4,000	...	0	..	...		200	130	...

* Pier repaired and tests discontinued. † Test boards during 1922 and 1923 failed to record any trace of limnoria.

wharves and submerged timbers in these harbors have likewise shown no trace of it. For example, boards operated near the Belle Docks in New Haven harbor for several years failed to record any trace of it until 1936. But in 1937 these boards show a heavy, destructive attack, and it is almost certain that the untreated bulkhead timbers and piling in the vicinity will be considerably damaged.

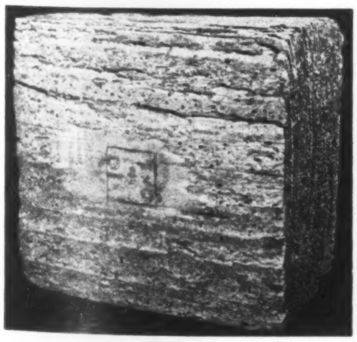


Teredo Navalis Invades New Haven, Conn.
External and Internal Views of Test-Board Section Attacked for First Time by This Organism Between August 1936 and January 1937

Other previously more-or-less immune harbors in which the test boards record a heavy teredo set in 1937 are Greenwich, Stamford, Norwalk, Bridgeport, Saybrook, and Stonington in Connecticut; and Providence, R.I. Unquestionably there has been a very great increase in the activity of this organism in New England harbors south of Cape Cod.

Of even greater importance is the fact that sets have been recorded in practically every harbor from Cape Cod north to Boston during the summer of 1937. North of Boston, *Teredo navalis* has recently appeared in destructive numbers in Winthrop, Salem, Beverly, Portland, and Searsport, and also in harbors in Nova Scotia and Newfoundland that are positively known to have been previously immune. There is thus abundant evidence that the range of *Teredo navalis* has been extended far to the north during the past three or four years. In addition, *Teredo tryoni* and *Teredo dilatata*, never previously recorded in structures in New England harbors, have caused considerable damage—the first in New London, Conn., and the latter in Beverly, Mass. *Teredo dilatata* is a much more destructive organism that *Teredo navalis;* an individual found in a test board in Beverly Harbor had reached a length of more than 30 in.

Unfortunately there are very few recent authentic records available in the vicinity of New York and Long Island, or in any of the harbors of the South Atlantic or Gulf states. No test boards are being operated in harbors south of southern Connecticut, and therefore the only information available has been secured from scattered observations which do not permit comparison with previous seasons. It is unfortunate that biological studies have not been conducted in southern harbors, since the evidence at hand indicates that the abnormally heavy destruction which occurred in New England harbors and northward in the summer of 1937 was duplicated in the vicinity of New York City and also at some of the southern ports.



Limnoria and Chelura Ravage a Standard Test Block Submerged for Eight Months in Boston Harbor

Bankia gouldi, found in waters immediately south of New England, is considerably more destructive than *Teredo navalis*. Its normal habitat is from New Jersey south to northern Florida, and also in most of the harbors in the Gulf of Mexico. It would seem reasonable to expect that the same factor which has caused the sudden invasion and survival of *Teredo navalis* in destructive numbers in many harbors north of Cape Cod, may result in a similar extension northward of the *Bankia gouldi* habitat. If the range of this organism should be extended northward to a degree comparable to that of *Teredo navalis*, it might be expected soon to appear in very destructive numbers in many of the harbors in New York, Connecticut, and Rhode Island, and in Massachusetts as far north as Cape Cod. This possible northward extension of the range of *Bankia gouldi* would be no more remarkable than that of *Teredo navalis*.

Present marine-borer research in this country is based on the marine-piling investigation conducted in 1922 and 1923 by the National Research Council under the direction of William G. Atwood, M. Am. Soc. C.E. During this investigation, studies were conducted and test boards operated in all the important harbors along the Atlantic Coast and the Gulf of Mexico. The report on the results of this investigation was published in 1924. A further study of some phases of the marine-borer problem in the harbors of the North Atlantic was begun in 1934 by the New England Marine-Piling Investigation Committee under the direction of the late Frank Shepherd. Since the death of Mr. Shepherd, the work has been continued by A. H. Morrill, M. Am. Soc. C.E., chief engineer of the Boston and Maine Central Railroad.

VALUE OF RESEARCH DEMONSTRATED

The original program adopted by the committee was limited to the placing of approximately 75 test boards in the more important harbors along the New England coast. The value of the research was quickly demonstrated, with the result that at the present time about 200 test boards are being operated from Newfoundland and Nova Scotia to the New York state line. The test board was originally designed to act as a marine-borer trap to obtain specimens of the destructive species for study, but it has now developed into a very valuable method for obtaining accurate information regarding the presence and comparative abundance of borers in marine structures. A large proportion of the boards now being operated are primarily for the purpose of determining the extent of marine-borer activity beneath important wharves. In addition to its scientific value, the test board may therefore be considered as an inexpensive form of insurance against the possibility of sudden, unexpected destruction in timber structures.

It was the study of test boards that first revealed the recent invasion of chelura in many New England harbors, the spread of *Teredo navalis* along the coast of northern New England, the appearance of *Teredo tryoni* in destructive numbers in New London, and the first record in New England of an attack on piling by *Teredo dilatata*. The test boards also first showed the recent migration of *Teredo navalis* up the river at Providence, R.I., and the excessive destruction due to *Teredo megotara* in Newfoundland harbors where no previous attack by molluscan borers had ever been recorded. The great increase in test-board operations during the past three years has been due to the value of such findings.

During the present investigation, the accumulation of water analyses has also been undertaken at as many test-board locations as possible, with the particular object of determining the effect of abnormal water conditions. The removal of some part of the pollution from many harbors has resulted in speculation as to the effect on marine-borer activity. There are some outstanding examples of greatly increased fauna and flora following harbor purification. The case of Lynn, Mass., may be cited. Here a large intake tunnel had been operated for more than thirty years previous to 1930. In 1931, the large sewer which had previously emptied directly into the harbor was extended to deep water, approximately three miles from shore. Until 1931, the intake tunnel had never required cleaning—there had been no appreciable accumulation of marine borers in more than thirty years. However, since the removal of pollution from the harbor, a deposit of many tons of marine organisms has accumulated so rapidly that the tunnel would be completely filled if it were not thoroughly cleaned each year.

SECTION OF TEST BOARD FROM EAST NORWALK, CONN.
Showing Extensive Damage Wrought by Teredo Navalis in Only Two Months of 1937

In observations of marine-borer activity published in the past, little distinction has been made between the various types of pollution. But recent observations seem to indicate that the nature of the pollution must be considered in order to prophesy with any degree of accuracy what changes may be expected in marine life following removal in a given area. For example, industrial wastes and catch-basin overflows usually appear to be far more effective barriers to marine-borer activity than does sewage.

It is certain that the continued accumulation of data (including the comparison of water analyses with marine-borer activity) will provide more definite knowledge in regard to the effect harbor purification may have on this problem.

It would also seem that some invasion of New York harbor by the destructive marine borers now thriving in the cleaner water nearby may be expected as a consequence of the sewage-disposal program which soon will be in effect in the harbor. It is therefore hoped that an effort will be made now to ascertain exactly what changes occur in the marine fauna and flora in the North and East rivers following a certain amount of harbor purification.

The program to be followed in future marine-borer research is dependent entirely upon the cooperation which may be expected from those directly interested. The following paragraphs outline briefly the more important studies that should be continued and in some cases, it is hoped, expanded.

ADDITIONAL TEST-BOARD INSTALLATIONS NEEDED

Test boards have proved of prime importance in marine-borer research, not only because of the value of the scientific data obtained, but also because they supply property owners with definite information regarding the extent of marine-borer activity beneath structures.

For these reasons, it would be of the greatest value if test-board installations could be made throughout New York harbor and in the more important harbors of the South Atlantic and the Gulf of Mexico. There is no other method so comparatively inexpensive by which a large amount of authentic data can be accumulated on the extent of, and the species responsible for, increased marine-borer destruction.

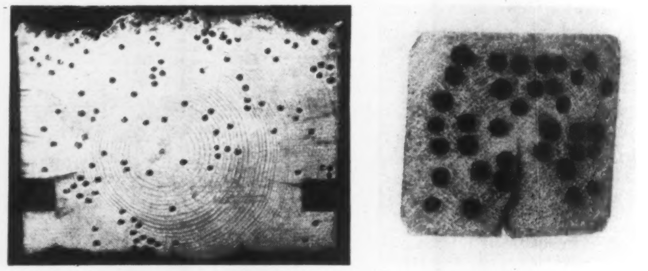
Studies of water conditions are made regularly at a number of locations where test boards are operated. In addition, a large number of industrial corporations and many municipalities are now cooperating by providing the laboratory with records of their water analyses.

Even with the comparatively small amount of information available at the present time, it has been possible in several instances to make decisions of great economic value. For example, the very thorough water studies which have been conducted in the harbor at St. John, N.B., have provided the scientific data which determined what protection, if any, would be needed to prevent marine-borer destruction of new structures in that location.

The necessity for the accumulation of data in connection with the service life in salt water of the various types of timber, timber treatments, and treating materials, has been so stressed that at the present time records are available of the exact condition of more than 300,000 piles.

Since many authorities are convinced that marine organisms are responsible for the deterioration of steels in salt water, similar service records are being accumulated on the life of the ferrous metals. Laboratories of the steel corporations and engineers of the federal government are cooperating in this effort.

The testing grounds being operated by the Marine Piling Committee in the tropics and in New England have proved to be of so much value that they are now firmly established on a permanent basis. Several hundred test timbers have been submerged and are being periodically inspected. Included in these tests are many treated timbers shipped from Europe, California, Oregon, and even Australia. There are many other less important, more or less interlocking ramifications which must be and are being considered in the study of marine-borer problems, but space will not permit their inclusion in this paper.

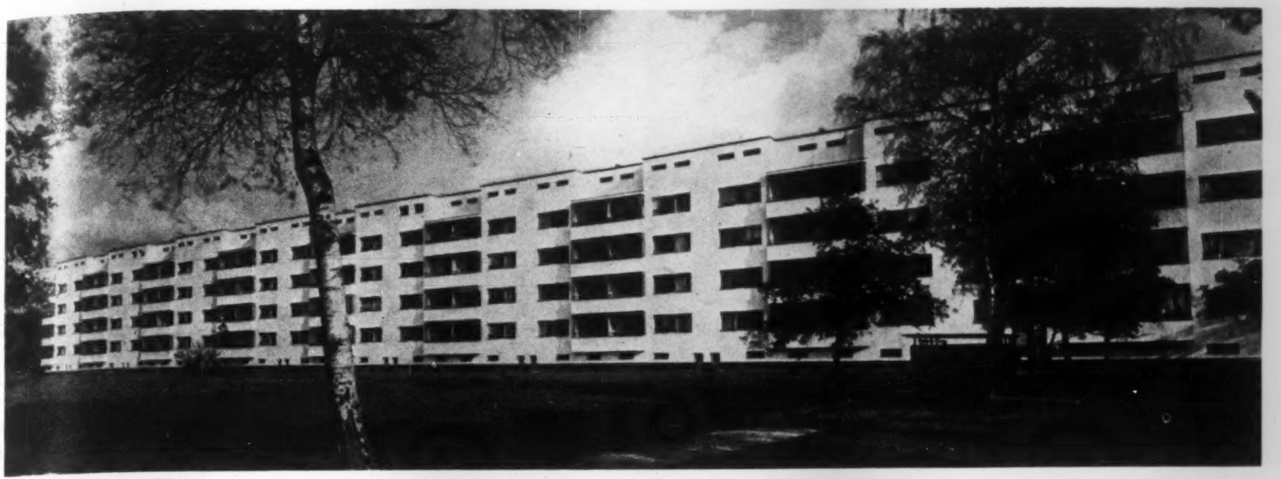


a *Teredo Navalis* Attack on Intake Tunnel Timber at South Boston, 1936

b *Teredo Dilatata* Destruction of Lobster Pot Buoy, Plymouth, 1935

TIMBERS IN MASSACHUSETTS HARBORS DEMONSTRATE ACCURATE MARKSMANSHIP ON THE PART OF THE TEREDO

The continuance of the entire research program, particularly operation of the testing grounds of the Marine Piling Committee, is dependent upon the cooperation of those most vitally interested. Nevertheless, it is gratifying to record the fact that valuable assistance in this research is being given by many who have no direct commercial interest in the hoped-for results.



Walter Gropius, Architect

MULTIPLE-FAMILY BLOCK IN SIEMENSSTADT, NEAR BERLIN

Background of the New Architecture

Both Technical and Cultural Qualities Required in Modern Work

By DR. WALTER GROPIUS

PROFESSOR OF ARCHITECTURE, GRADUATE SCHOOL OF DESIGN, HARVARD UNIVERSITY, CAMBRIDGE, MASS.

TECHNICAL skill plus vision are the hallmarks of the good architect, just as they are of the capable engineer. In the case of the architect, vision includes a knowledge of material and abstract space, giving due weight to the factors of optical illusion, proportion and scale, rhythm, color, light, and shade. The new architecture, says Dr. Gropius, starts with the dictum that form should follow function, with the added proviso that the highest human aspirations be expressed as adequately as the character of the structure will permit. Wider use of glass and the development of low-cost prefabricated housing exemplify some of the modern trends. The article is abstracted from the address delivered by Dr. Gropius on October 6, 1937, at a general session during the Society's Fall Meeting in Boston, Mass.

TODAY it may be shown conclusively that the outward forms of modern architecture are not the whim of a few artists eager for innovation, but the inevitable product of the intellectual, social, and technical conditions of our age. A breach has been made with the past; the morphology of dead styles has been destroyed; and we are returning to simplicity, clear thought, and feeling—that is to say, we try to go our own way instead of imitating the products of earlier periods.

The similarity among modern buildings throughout the world, so evident in spite of distinct national as well as individual characteristics, indicates that their common roots are derived from technical rather than political revolutions. It is amusing to find that the same phenomenon, the new architecture, is called "western bourgeoisie" in Russia, "Bolshevism" in Germany, and "the true Fascistic style" in Italy.

But this development has encountered obstacles—confusing dogmas, theories, technical difficulties, and formalistic will-o'-the-wisps. Again, phrases like "functionalism" and "fitness for purpose equals beauty" have deflected appreciation of the new architecture into minor and purely external channels. The idea of rationalization which many people aver is the outstanding characteristic of the new architecture is in reality only a part of its role. The other aspect, the satisfaction of the human soul, is just as important as the material, and both unite as in life itself.

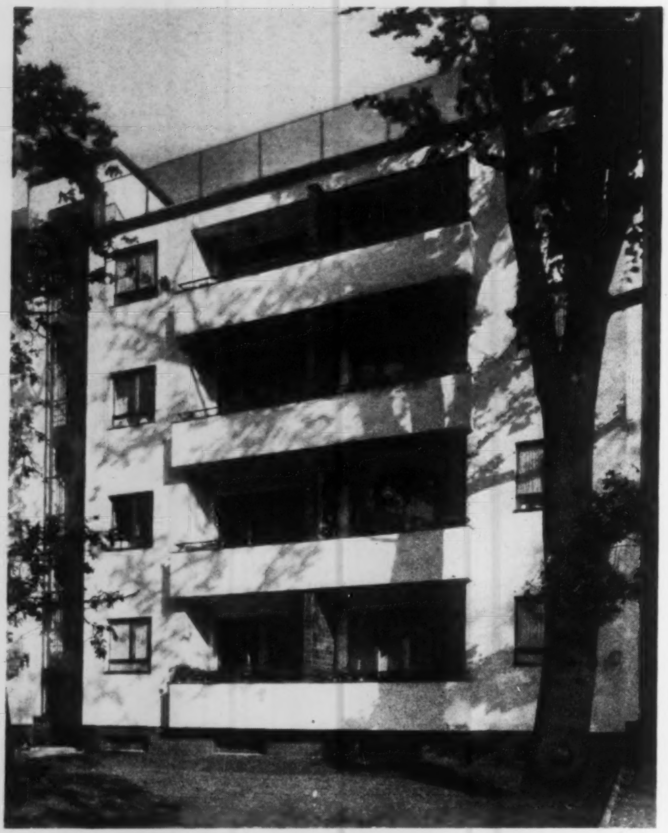
Again, the liberation of architecture from the mass of ornament, the emphasis on the function of its structural members, and the quest for concise and economical solutions represent merely the material side of that formalizing process on which the practical value of the new architecture depends. Far more important is the intellectual achievement which has made possible new vision and new form. For whereas the practical side of building is a matter of construction and materials, the very nature of architecture makes it dependent on the mastery of space.

For a century the transformation from manual to machine production so preoccupied humanity that men were content with borrowed styles and formalistic decorations. But this state of affairs is over at last. A new conception has developed, based on realities, and with it has come a changed perception of space—a new form. The dissimilar appearance of numerous good examples of new architecture which already exist exemplify these changes and the new technical means we have at our disposal as a result of them.

ARCHITECTURE IN THE PRE-WAR PERIOD

In this connection it may be of interest to contrast the actual founders of the new architecture up to 1914, exemplifying each by one of his major works. The governing factors in my choice will be not the beauty of the buildings concerned but the degree of independence and creative achievement with which, in these buildings, the architects definitely enriched the movement. With one exception—St. Elia—this choice is based not upon paper projects but upon executed designs, a consideration which seems to me of some importance.

During this pre-War period, Auguste Perret was the most advanced leader in France. The Théâtre des Champs Elysées in Paris, built in 1911–1913, was designed by Perret in collaboration with Van de Velde, who was then living in Weimar. Perret's chief title to



Walter Gropius, Architect

TWO-AND-ONE-HALF-ROOM APARTMENTS IN SIEMENSSTADT, NEAR BERLIN

fame is his extraordinary constructive skill, which altogether eclipses his gifts as a spatial designer. Although more engineer than architect, he undoubtedly belongs to the founders of modern architecture. About the same time Adolf Loos began writing those articles and books in which he set forth the fundamentals of the new architecture, and building that large shop in the Michael Place, Vienna, immediately opposite the Hofburg Imperial Palace, which so inflamed the passions of the population, accustomed to baroque forms.

In 1913, futurism was launched in Italy. Of this St. Elia, who unfortunately fell in the War, was one of the leading adherents. At the Triennale Exhibition in Milan, 1934, his memory was invoked by Marinetti, the founder of futurism, as one of the great originators of the new architecture. In 1913, St. Elia wrote astonishingly accurate anticipations of the ideology of the common architecture, but he never had a chance to carry out any practical work. His project for a skyscraper on a four-tiered street remained a paper design.

In the United States the revival of architecture had begun as far back as the nineties, being coincident with the development of a new constructional technique. About the end of the century, Sullivan constructed buildings of an epoch-making type, using steel skeletons for skyscrapers, and also formulated architectural principles which contained the elements of the functional doctrines of today. We must not forget that it was Sullivan who wrote, "Form should follow function." Intellectually speaking, his ideas were even more fundamental and original than those of Frank Lloyd Wright, who was later to inspire so many European architects in both a spatial and a structural way.

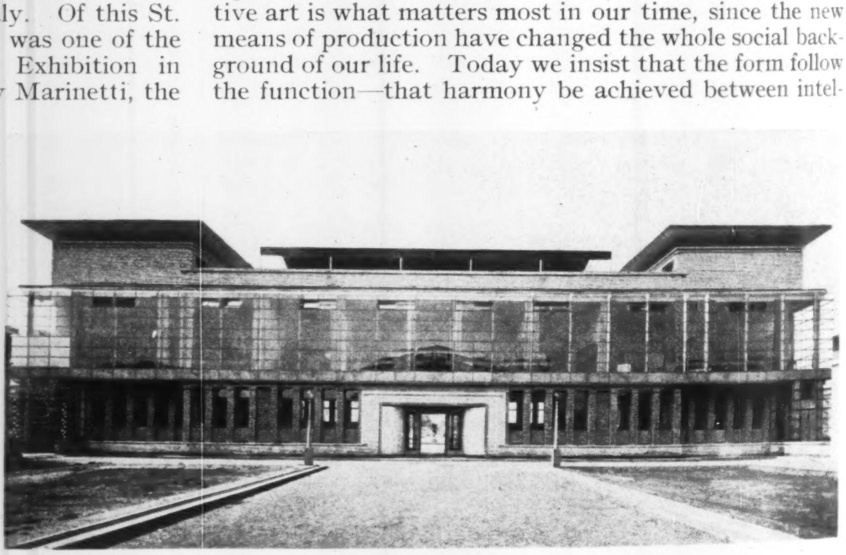
But even today both Sullivan and Wright are hardly recognized in their own country, and the first opportunity for a genuine American style thus passed away. And so, although my investigations in 1928 convinced me that the United States has the most fully developed constructional technique of any nation in the world, the creative artistic development has not kept pace. The phrase "imported from Europe" was still too highly regarded in 1928. Since then, however, the future of an American architecture independent of Europe has seemed much more promising.

Returning to the pre-War period, I emphasize that Germany played the leading role in the development of the new architecture in Europe. Here individuals like Peter Behrens, Hans Poelzig, and myself were aided in trying to bring forward the new conception of architecture by the Deutscher Werkbund—a body which constituted a reservoir for the forces of progress and renewal. Its membership was composed of architects, artists, industrialists, and craftsmen; its aim was to integrate their various activities. Later this influential body was widely recognized by the public and by the authorities. At the close of the War the new architecture blossomed forth simultaneously in several centers, but particularly in Germany and Holland.

During the rise of machine production, true national art gradually died out. The old conception of the basic unity of all art was gradually replaced by the esthetic "art for art's sake" and the even more dangerous philosophy, "business as an end in itself," from which it sprang. The resulting attitude of sentimental longing for historical forms, which still dominates our present generation, must be overcome before true creative art, adopting the machine as the modern vehicle of form, can again permeate our communities.

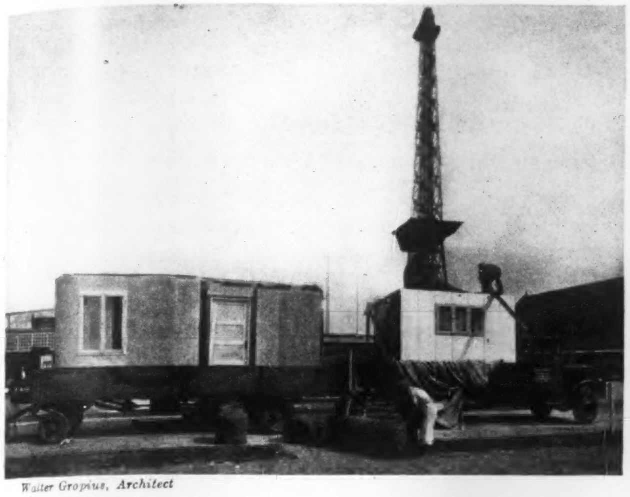
WHAT IS CREATIVE ART?

When Goethe first saw the Strasbourg Cathedral, he discovered the difference between "formative art" as a new creative vision, and "fine art" as a well-balanced discipline toward a classic system of esthetic norms. Formative art is what matters most in our time, since the new means of production have changed the whole social background of our life. Today we insist that the form follow the function—that harmony be achieved between intel-



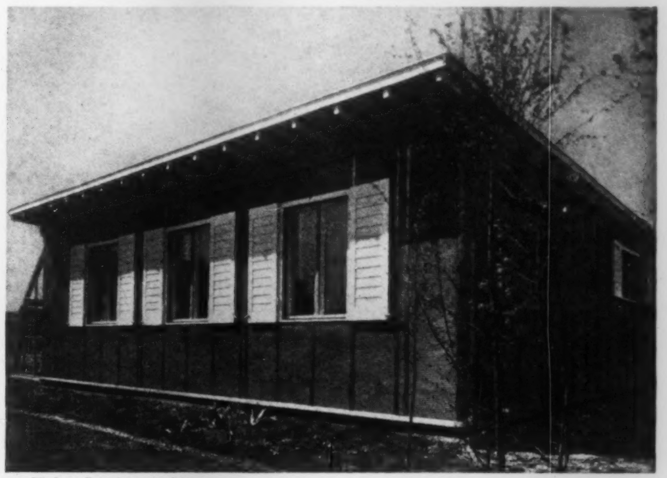
Walter Gropius, Architect

OFFICE BUILDING WITH ROOF GARDEN, WHICH WAS BUILT IN COLOGNE IN 1914 lect and desire—and are once again striving toward unity in the cultural world around us. The age just passed, with its isms and its historical imitations, was perhaps merely the reflection of our unconscious desire to probe all the secrets of the existing world, in order to overlook nothing of importance in building up the new world.



Walter Gropius, Architect

Entire House, with Wiring, Transported on Truck and Trailer



Walter Gropius, Architect

The House as It Appeared After Erection

Four-Room Prefabricated Copper Houses as Constructed in Germany in 1932

The modern architect's guiding principle is that artistic design is neither wholly intellectual nor wholly material, but rather an integral part of the very stuff of life. He deals with the science of technique—that is to say, with materials and construction; and, in addition, with the science of space—that is, the knowledge of material and abstract space, of optical illusions, of proportion and scale, rhythm, color, light, and shade. The architect must master both these problems. He cannot be a good architect without being a skillful builder and a man of vision.

NEW CONSTRUCTION TECHNIQUE DEVELOPS

One of the outstanding achievements of the new construction technique has been abolition of the supporting function of walls. Instead of building walls as supporting members, as in a brick house with windows, the whole load of the structure is carried by a steel or reinforced-concrete framework. The use of these new materials restricts the role of the walls between the supporting members to mere screens for keeping out rain, heat, cold, and noise. With the object of reducing weight, these non-bearing walls are often built of light-weight concrete or comparable material in the form of thin slabs or blocks. This construction, by reducing the cross-sectional area of the supporting members, has led to much better lighting. The old type of window, taken out of the full thickness of the supporting wall, is being replaced by the continuous horizontal window divided by thin steel mullions. Glass has thus become of greater structural importance, enlivening the aspect of the modern house.

The principle that mass-production should be applied to house construction aroused the greatest opposition, as I know since I supported this demand myself from 1910 onward. The individuals who opposed this idea feared that such transformation would produce overwhelming monotony of form and decay of the handicrafts. Also large commercial interests opposed it, from less worthy motives. Yet the manufacturing of everyday goods by machine has increased, not decreased, the number of kinds of goods. The same will happen with prefabricated houses.

Any danger of "monotonization" of form will be overcome when it becomes possible to manufacture in quantity the component parts of houses, since different types of houses can then be assembled in forms which will correspond to the needs of the individual. For houses, the goal to be aimed at is, therefore, the "box of bricks" for adults. However, the changes in the building trade which will be necessitated to meet this goal are so far-reaching that another generation may well go by before the production of houses by machinery becomes an accomplished fact. The difficulties in the way are psychological as well as technical, but I think that here is indeed America's chance, as she is not so burdened with tradition as are most of the European nations.

The setting up of standards is in no sense an achievement of our age; it is only the methods used for arriving at a standard which have changed. Standards have always represented certain *ne plus ultra* zeniths of cultural achievement—a selection from all that is best, a winnowing of all that is vital and impersonal from that which is personal and incidental.

Among the many attempts that have been made to produce houses under factory conditions, I should like to cite one of my own. I prepared the plans for mass-produced copper houses erected by a large metallurgical firm in Berlin, which was operating under a patent for the insulation of walls with aluminum foil. The outstanding characteristics of these houses are a very high degree of insulation combined with extreme lightness—a four-room house, complete with walls and roof, doors hung, windows glazed, and electric wiring installed, can be transported from the factory to the site on a single motor truck and trailer. A copper wall, complete with interior and exterior facings, weighs only about 26 lb per sq yd, yet its insulating properties are equal to those of a 56-in. brick wall. Wall sections up to 20 ft in length can be finished as separate units on the endless chain, dispatched from the works, and unloaded and erected on the site by hand with the aid of only four men.

In spite of my familiarity with the plans for prefabricated houses here and abroad, I feel that the problem is too involved to be solved by single persons or single firms. The whole building industry must collaborate by manufacturing standardized component building parts.

Walter Gropius, through Courtesy of the "Architectural Review"

MODERN RESIDENCE BUILT IN CHELSEA, LONDON, IN 1936

The appalling housing shortage after the War stimulated every one in the building industry—architects, contractors, engineers, and public authorities—to reexplore the problem of providing homes from the social, technical, and economic point of view. Far-reaching departures from the old methods ensued, with the result that our attitude towards housing has changed radically. Moreover, new means for, and increased speed of, transportation have partially obliterated the boundary between town and country. The modern man needs contrast, both as a stimulus and as a recreation, and is insistent in his demand for more spacious, open-planned, and above all, greener and sunnier cities; and for the separation of industrial and commercial districts from residential by means of properly coordinated transport services.

Opinion is still very widely divided as to what is the ideal form of dwelling for the bulk of the population—separate houses with their own gardens, or multiple-family dwellings of medium height (three to five floors) or of ten to twelve stories. It is indisputable that to most people the individual house seems most attractive, and this I wish to emphasize strongly before coming to different suggestions for the overcrowded industrial districts of towns. Tenement blocks represent a kind of housing which cannot be regarded as a necessary evil, if they are properly planned, for the slum problem cannot be solved with cottages only.

The tenement block has come into disrepute because in its original three- to four-story form, as generally used in Europe, it could claim few advantages. The interval between the separate blocks was generally far too small; the degree of sunlight was wholly insufficient; and community gardens, if provided at all, were entirely inadequate. But if the present much-reduced maximum permissible number of separate dwellings to the acre within a given area be concentrated in widely spaced ten- to twelve-story instead of three- to five-story blocks, all of these disadvantages are removed.

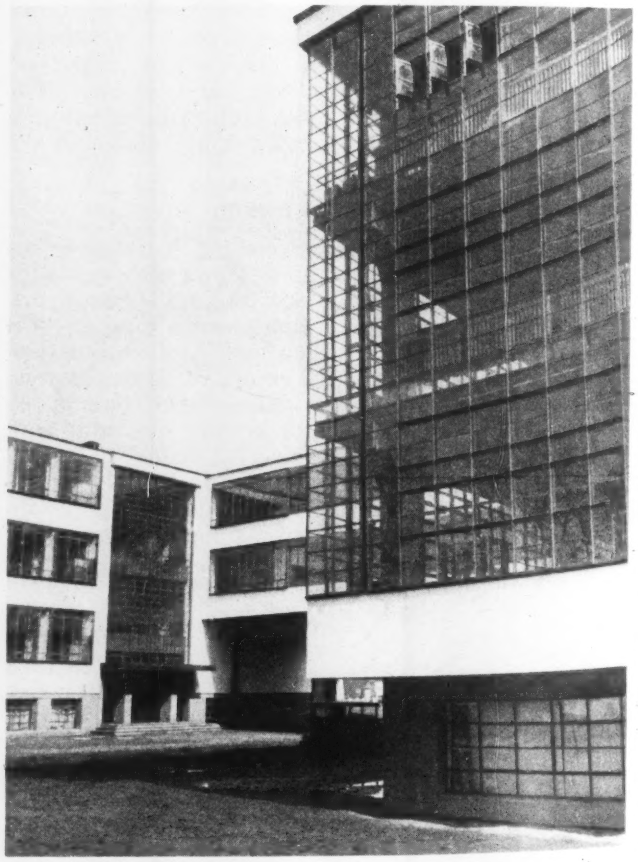
When conscientiously planned, with broad stretches of garden between them, ten-to twelve-story tenement blocks satisfy all the requirements for light, air, quiet, and rapid egress. In this sort of block, ground-floor tenants are assured of a clear view of the sky. Instead of looking on blank walls or into narrow wells or corridors, they have an uninterrupted view of expanses of grass and trees, more than 300 ft in breadth, which provide playgrounds for the children. By this means nature is able to reassert herself in the bosom of the city. If the flat roofs of these buildings are transformed into gardens, all the terrors of the tenement block disappear and the tenant finds he has become the citizen of a green city, where contact with nature is a daily experience instead of an occasional Sunday one.

The aim should thus be planning for low or tall buildings. The low-building construction should be restricted as far as is possible to two-story houses in outer urban zones with a very low density per acre, and the tall buildings should follow the rational form of ten- to twelve-story blocks with full communal conveniences in all parts of the city where their practical utility has been proved, especially in zones with an inevitably high density per acre. Building blocks of intermediate height in these districts do not have the advantages either of small houses or of multiple-story tenements, and their disappearance should be considered a step in the right direction.

NEW MOVEMENT IN ARCHITECTURE PROVED GENUINE

To sum up, these proofs of the genuineness of the new movement in architecture are so evident that no one can possibly still maintain that it is based on a traditional infatuation for technique qua technique which blindly seeks to eliminate all national characteristics and is bound to end in a glorification of materialism. The laws which restrict the choice of the individual have been established as a result of the most thorough social, technical, and artistic investigations. Furthermore, I believe that our conception of the new architecture is nowhere out of line with tradition, since tradition does not consist of imitating old styles, and respect for tradition does not warrant the comfortable enjoyment of those elements which are merely a matter of chance or convenience. It is and always has been a struggle for essentials, a struggle to get at what is at the back of all technique and is forever seeking visible expression.

May I conclude by expressing the hope that the architects and engineers on this great continent may work ever closer together, to establish an independent American style of architecture.



Walter Gropius, Architect

THE BAUHAUS, A UNIVERSITY BUILDING ERECTED IN DESSAU, GERMANY, IN 1926

Pier Reconstruction in Boston Harbor

Outlining Two Distinct Methods for Repairing Wood-Pile Structures Damaged by Borers

ILLUSTRATIONS of severe damage caused by marine borers to wood piers in the harbor of Boston, Mass., appeared in two of the papers delivered on October 7, 1937, before the Waterways Division at the Fall Meeting of the Society. These papers, of which summaries are presented herewith, describe in detail the extensive work required to restore the structures to a safe condition.

In the case of Commonwealth Pier No. 5, the destruction had affected about 92 per cent of the piles, and of this group about 10 per cent had been one-half or more destroyed. Among the interesting features of the reconstruction work, as related by Professor Spofford, were the use of steel bearing piles in lengths up to 137 ft, and the utilization of light-weight cinder concrete to protect some of the existing wood piles from further damage.

At the Army Base wharf, harbor-bottom conditions were better and damage to piles not quite so extensive. In consequence, Major Miller recommended and carried out a different method for making repairs, consisting principally in the installation of a steel sheet-pile bulkhead, adequately braced to the existing structure, around the entire base, and filling inside it and around the wood piles with sand. Both methods proved entirely effective.

Reconstructing a Wood-Pile Pier

STEEL bearing piles having a maximum length of 137 ft—believed to be the longest steel bearing piles ever used—were substituted for wooden piles supporting the outer portions of Commonwealth Pier No. 5, at Boston, Mass., recently, as described by Charles M. Spofford, M. Am. Soc. C.E., consulting engineer, of Fay, Spofford and Thorndike, Boston, Mass. The piles were driven by steam-hammer through fill and blue clay to a bearing on bedrock or the hard material immediately overlying it, replacing wood piles which had been seriously damaged by marine borers. The concrete deck of the old structure and its supporting concrete beams were removed for the most part and replaced by a new concrete deck supported on steel beams and girders. The use of light-weight concrete to protect certain wooden piles from further damage is also of interest.

Commonwealth Pier No. 5 is the principal pier for passenger ships on the south side of Boston harbor, providing berth space totaling 2,600 ft in length, with a depth of water of at least 40 ft at mean low tide. The original construction and the reconstruction of the pier in 1912–1913 were both under the direction of Frank W. Hodgdon, first as chief engineer of the State Board of Harbor and Land Commissioners and later as chief engineer of the Directors of the Port of Boston.

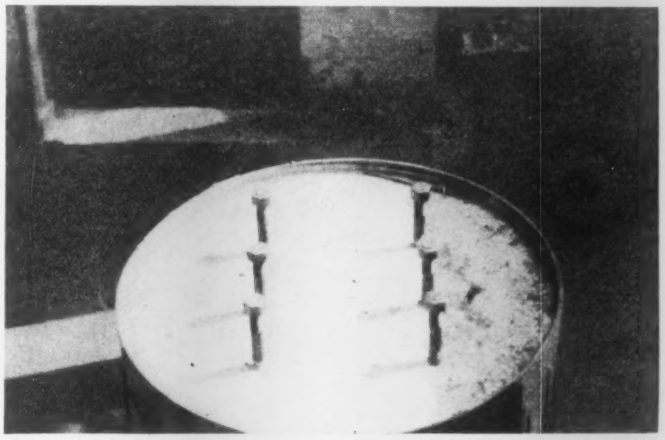
The pier was begun in 1897 by building a granite sea wall around a site 300 ft wide and 1,150 ft long and filling the interior with dredged material. The wall was supported on spruce piles and caps, the spaces between and in front of the piles being filled with small stone chips and gravel. The face of the slope in front of the wall was also protected by larger stones weighing 100 to 300 lb each. After completion of the solid portion of the pier it was surrounded by a 50-ft platform of hard pine supported on oak piles. The heads of these piles were covered with coal tar but no other preservative was used. The total cost of this portion of the pier was just under $400,000.

In July 1907 a portion of the pier was seriously damaged by fire. In November 1912, the Directors of the Port regained control of the pier from the Old Colony Railroad, lessees, and began making certain improvements, which were completed in May 1913 at a cost of approximately $4,000,000.

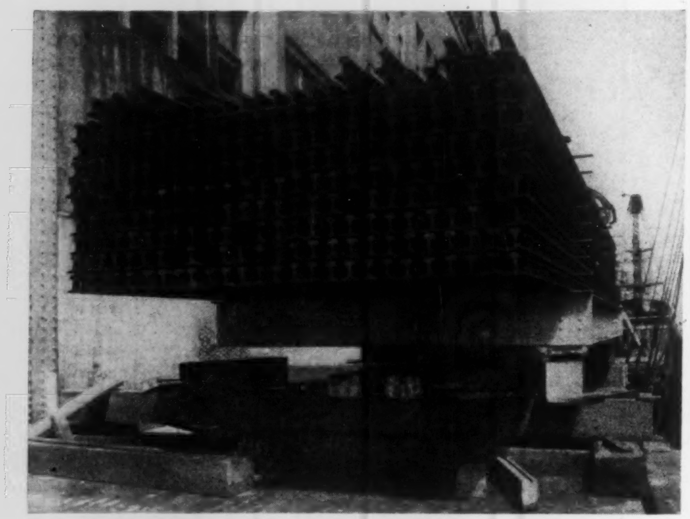
In 1925 the attention of the Massachusetts Department of Public Works was called to the fact that marine borers were becoming active in Boston harbor. Divers were sent down in 1925, 1932, and 1934 to investigate the extent of the pier destruction. The 1925 examination showed that approximately 55 per cent of the oak piles examined had been attacked. In 1934, however, about 92 per cent of the piles were affected, and of this group about 10 per cent has been one-half or more destroyed. It was later discovered that piles upon which the original bark remained in place were in good condition. The major part of the damage was caused by limnoria.

The reconstruction work was begun in January 1936, and completed in May 1937, at a cost of about $780,450, exclusive of certain claims not yet adjusted. Preliminary borings indicated that the underlying bedrock consisted of seamy slate rock varying in elevation from 94.00 to 142.67 ft below mean low tide. Three different types of bulkhead construction were considered for the reconstruction of platforms and pile foundations, but all proved impracticable, and after considerable study the following method was adopted.

The riprap and a portion of the silt in each area were excavated to as great a depth as feasible, and a steel caisson 4 ft 6 in. in diameter was driven, generally by steam-hammer, to a minimum depth of 5 ft into the clay subsoil, with its top at the proposed level of the bottom of the new steel-and-concrete deck. The material within the caisson was then excavated to a depth of 15 ft below the anticipated level of the tops of the piles. Four 14-in. by $14^1/_2$-in. steel bearing piles, weighing 89 lb per ft,



VIEW OF TOP OF A CYLINDER PIER, WITH CONCRETE POURED AND ANCHOR BOLTS SET



ARRANGEMENT OF RAILS ON LOADING PLATFORM FOR TEST ON 134-FT STEEL PILE, COMMONWEALTH PIER NO. 5

were next driven to bedrock inside each caisson by a steam-hammer. Each pile was designed for a load of 100 tons, and all except a few piles had to be spliced at least once (some twice). The splices contained 36 shop rivets and 44 field rivets—a sufficient number to carry the load in an ample manner even if half should be loosened during driving.

A 2-ft layer of sand and gravel was now deposited within each caisson around the piles and over the surface of the soil, to form the bottom for the concrete, which was poured by chute to the tops of the caissons. The cylinder piers thus formed were for the greater portion of the work spaced 40 ft center to center longitudinally and from 19 ft 5 in. to 27 ft 3 in. center to center transversely. They supported the framework for the concrete deck, which consisted chiefly of 30-in. and 36-in. H-beams of silicon steel placed longitudinally, supporting transverse H-beams, also of silicon steel. The longitudinal beams were usually continuous over two spans.

At the shoreward end of the pier, under the head house (a massive brick building extending out to within 20 ft of the face of the wharf platform), the method just described could not be used on account of the difficulty of supporting temporarily the heavy concrete columns and brick walls. Finally it was decided to drive a light-weight steel sheet-pile bulkhead just outside the foundations, and to fill the space between it and the existing sea wall under the head house up to low-water level with light-weight concrete. Forms were built around the pile clusters and bents and filled with light-weight concrete, thus obtaining protection without removing any of the structure.

Acknowledgment for assistance in preparing the paper was made to John Ayer, M. Am. Soc. C.E., who represented the consulting engineers during the progress of the construction work, and to Charles J. O'Donnell, who served as resident engineer.

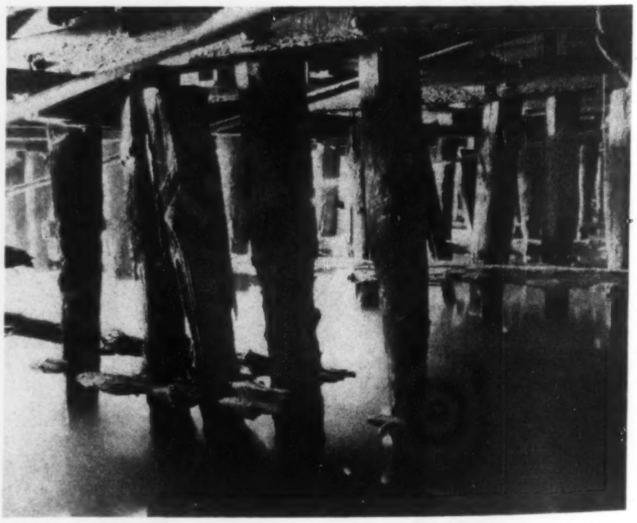
Repairing Substructure of the Army Base

BUILT during 1918 and 1919 for use of the Quartermaster Corps of the U. S. Army, the wood wharf substructure of the Army Base at Boston, Mass., has suffered severe damage by marine-borer activity. The manner in which repairs were made in 1935–1936 was described in considerable detail by Major Robert L. Miller, Constructing Quartermaster in charge of the investigation and repair work.

The Army Base at Boston consists of a continuous structure 4,100 ft long, giving a total wharf distance of 5,400 ft, with four large storage warehouses and the necessary power plants, railroad tracks, and roads. The original cost of construction to the federal government was about $25,000,000. About 28,000 southern-pine piles, placed chiefly in transverse bents on 10.5-ft centers, were used to support the wharf structure and three of the storage buildings. These piles were 30 to 65 ft in length, and were driven with the bark on. They were cut at about the level of high tide and were braced between high and low water. Concrete girders 18 in. wide and of varying depths, resting on the pile heads, were used to support the 10-in. concrete deck of the wharf.

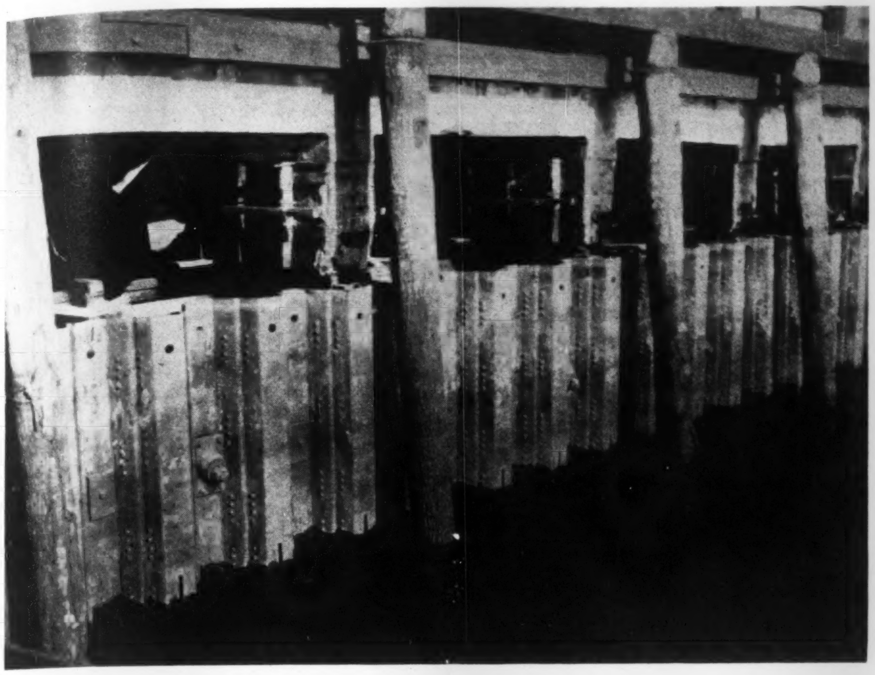
Activity of marine borers was first noticed in 1922 and by 1932 the destruction wrought by these organisms had reached a point such that remedial measures were necessary. Aided by John Ayer, M. Am. Soc. C.E., of Fay, Spofford and Thorndike, and George L. Mirick, who had been resident engineer on construction of the Base, Major Miller started on a careful investigation of approximately 10 per cent of the piles. This survey was conducted above the water surface from boats and beneath the surface by a diver. Results indicated that approximately 30 per cent of the original pile cross-section had been eaten away, as well as practically all low-water and diagonal bracing and some of the longitudinal bracing near high tide. Attacks extended from the mud line to some distance above low water. Piles on which the bark remained were not subject to attack.

A report, made in November 1933, was forwarded to the Quartermaster Corps of the War Department with recommendation for early provision of funds for repairs. Plans were completed early in 1935 and approximately $1,000,000 was made available by PWA. These plans called for the installation of a steel sheet-pile bulkhead together with all necessary wales, tie-rods, anchorages, and accessories, around the entire base, to retain a run-of-bank sand fill which was to be placed around the wood piles. The work also included constructing a new fender system, replacing and reinforcing such underpinning as



APPROXIMATELY 30 PER CENT OF THE ORIGINAL PILE CROSS-SECTION AT THE ARMY BASE WAS EATEN AWAY IN 14 YEARS

Practically All Low-Water and Diagonal Bracing and Some of the Longitudinal Bracing near High Tide Was Also Destroyed funds would permit, and the extension of certain storm sewers.



View of Sheet-Steel Bulkhead and Fender System After Completion of Repairs to Boston Army Base

The steel sheet piling was of the standard deep-section interlocking type, having a minimum thickness of $^{3}/_{8}$ in. and a weight of not less than 32 lb per sq ft, reinforced by steel plates riveted to the outside of the "U." The bulkhead was braced by means of steel rods $2^{1}/_{4}$ and $2^{1}/_{2}$ in. in diameter, anchored to the 18-in. concrete beams in the existing floor system.

The first step in the actual construction work was the drilling of openings in these beams for rod anchorages. Specially designed beam anchors, consisting of two 12-in. channels 6 in. back to back, were then grouted into place in the beams. Carpenters placed rod supports by spiking planks to the existing wood piles, and the rods were then installed and spirally wrapped with 12-in. waterproofing fabric, with laps of 6 in., tied firmly in place. A coating of asphalt emulsion was then applied so as to thoroughly penetrate and seal the wrapping. The rods were protected before the filling was begun by means of inverted U-shaped wood troughs. Horizontal steel wales, consisting of two channels 10 or 12 in. back to back, with necessary plates and rod-fittings, were in most cases installed on wood brackets secured to the outside wood piles before the sheet piles were driven. This was done for ease in construction. Such wales later served as guides for driving the piling. Castings and plates for fastening the rods to the wales were also installed at this time.

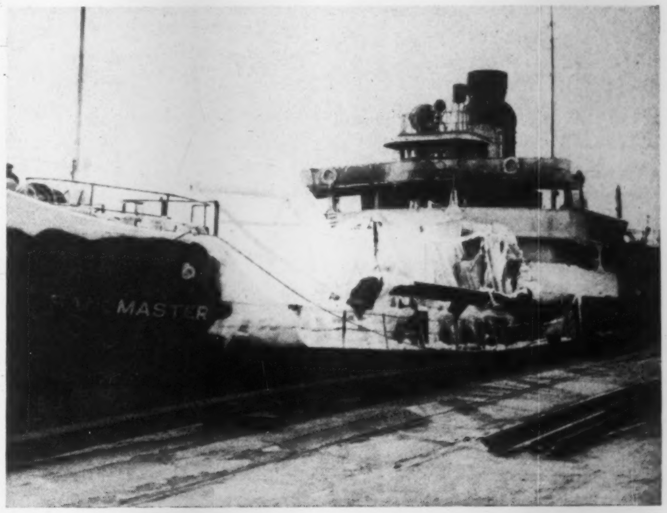
Piling, which was in lengths of 45, 50, 52, and 65 ft, was driven through a special portable timber frame to insure accuracy of position. Where ledge was encountered in driving the piling before it had reached the desired penetration, 6-ft steel pins, 4 in. in diameter, were grouted approximately 4 ft into the ledge at the foot of the piling to prevent it from moving out, drilling, placing, and grouting being done through 6-in. iron pipes extending above the water line. At one point, where the ledge was not of the proper structure to retain steel pins, a cellular deadman of interlocking steel sheet piling was constructed, filled with sand, and capped with concrete. The bulkhead was then anchored to the deadman instead of to the pins.

Defective wood piles having a diameter of less than 4 in. at the mud line were replaced either by cutting at the mud line and capping with a new pile, drilling holes in the deck and driving twin piles on both sides, or by encasing the old pile in a concrete shell. New yellow-pine piles were driven in most areas where the necessary machinery could be set up. Pile encasement was done through a steel form of sheet iron 4 ft long and 14 in. in diameter, with a sheet-metal collar at the bottom and provision for withdrawal from the pile after the concrete had set.

The old fender-pile system was removed throughout the entire length of the wharf and replaced by 60 to 65-ft oak piles with 12 by 12-in. yellow-pine caps. To fill the space between the new fender caps and the old concrete deck, an 18 by 16-in. timber was bolted to the concrete face and a 12 by 12-in. timber placed above it. Holes in the deck made for driving new wood piles were later closed with reinforced concrete.

The coarse beach sand used for the fill under the wharf was pumped into place by a Diesel-electric-powered hopper dredge. Pipes were installed under the wharf with openings distributed so as to place the fill evenly over the entire area. At high tide the fill spread an average of 60 ft radially from the discharge end of the pipe, and at low tide a greater spread was obtained. A total of 292,607 cu yd of fill was placed under the wharf in all.

In closing, Major Miller emphasized that the repair work was done without serious interruption to water traffic. The contract was awarded in April 1935 and completed in March 1936, and both water and rail equipment were used in the work.



The Hopper Dredge "Sandmaster," Operated by Diesel-Electric Power, Pumped Almost 300,000 Cu Yd of Coarse Beach Sand Under the Wharf

Recent Sanitary Engineering Studies

Decomposition of River Deposits and Pollution of Boston Harbor Are Subjects of Investigations

PAPERS on two aspects of the problem of water pollution comprised the program of the Sanitary Engineering Division at the 1937 Fall Meeting in Boston. Their scope does not permit of adequate treatment in "Civil Engineering," and they are accordingly presented here in brief outline only, with the thought that they may later be published more or less in full in the "Proceedings" of the Society.

In the first paper, Messrs. Fair and Moore report the results of a laboratory investigation of benthal decomposition—that is, decomposition of organic matter on the beds of streams—with particular reference to the rate at which it takes place. In the second paper, Messrs. Weston and Edwards describe a detailed study of the pollution of Boston harbor, and outline the most economical method for abating the nuisance.

Decomposition of River Deposits

AN APPRECIABLE part of the suspended matter carried into a stream may settle in ponds and sluggish reaches to form bottom deposits. The organic portion of these deposits is subject to decay, but the processes of decomposition are different from those obtaining in flowing water. In deposits of any appreciable thickness, decomposition proceeds both aerobically (in the surface layers) and anaerobically (in the underlying strata). The action is further complicated by the activities of living organisms of a higher order than bacteria—mollusks, larvae, and worms.

The interest of sanitary engineers in the decomposition of river deposits ("benthal" decomposition) centers in its effects on the quality of the supernatant water—its oxygen content, turbidity, color, odor, pH concentration, and so forth. Recent laboratory research at the Harvard Graduate School of Engineering has brought out considerable data on the subject, the most important conclusion being that benthal decomposition is by no means as rapid as that of strictly aerobic decomposition in flowing water, or even that of strictly anaerobic decomposition of well-seeded sewage sludge in heated tanks. The studies were reported in a paper by Gordon M. Fair, M. Am. Soc. C.E., professor of sanitary engineering, and Edward W. Moore, instructor in sanitary chemistry, both of the Harvard Graduate School of Engineering, Harvard University, Cambridge, Mass.

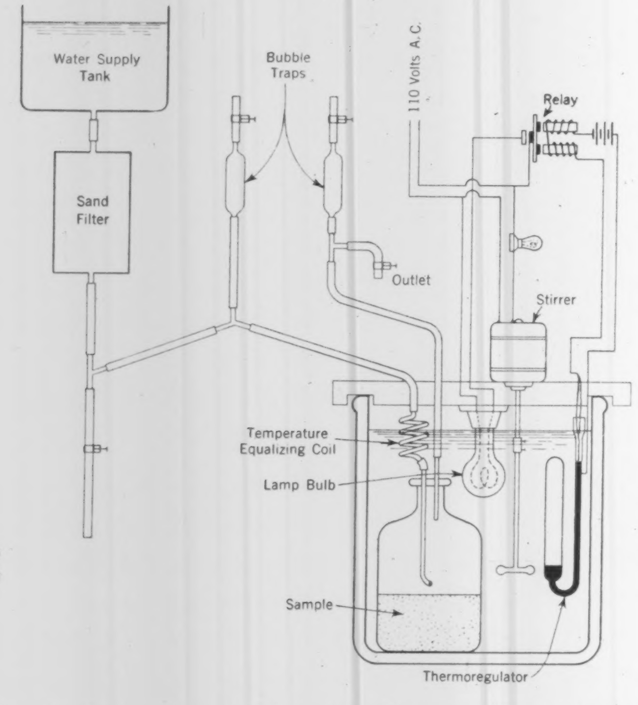


FIG. 1. APPARATUS FOR STUDYING BENTHAL DECOMPOSITION UNDER CONTROLLED CONDITIONS

In order to follow the processes of decomposition that are operative in a river deposit, a sample of bottom sediment was brought into the laboratory and portions were allowed to settle in bottles through which a controlled flow of water was maintained. The experimental apparatus (Fig. 1) reproduced the conditions encountered in a flowing stream, without the interference of changing hydrographic elements, large variations in temperature, and the chance addition of fresh sediment. The progress of decomposition was measured in terms of the oxygen removed from the flowing water. In addition, the quantities of iron and nitrogen appearing in the water, and the changes in volatile-matter content, B.O.D., and fuel value of the mud were determined from time to time. Observations were continued for 145 days.

The experimental data show that it is possible to analyze the results of benthal decomposition mathematically in the same manner as those of aerobic and anaerobic decomposition. Comparison of the mathematical parameters of decomposition thus becomes possible. In the test sample the reaction-velocity constant (on a daily basis) varied from 0.0004 at 10 C to 0.00084 at 25 C, as compared with a value of 0.1 at 20 C for the normal first-stage B.O.D. of polluted water. The time required (at 25 C) for 90 per cent satisfaction of demand is estimated at 3.3 years, as compared with 8 days in the normal first-stage B.O.D. of polluted water at the same temperature. It was also noted that benthal decomposition responds more rapidly to changes in temperature.

Under benthal conditions, between one-third and one-half of the reduction in B.O.D. in the layer of mud studied appeared to be accomplished by aerobic decomposition, and the remainder by anaerobic decomposition. The depth of the deposit obviously has an important bearing upon the proportion of the demand satisfied by the two methods of destruction; the greater the depth, the smaller the ratio of aerobic decomposition must be expected to be.

The reaction-velocity constants of benthal decomposition are closest to those of anaerobic decomposition of unseeded sewage sludge, though in the river deposit studied they were still only about one-seventh those of the latter. This difference may be explainable by the lower concentration of volatile solids in the river sediment, which is less conducive to mobility of the products of decomposition and to maintenance of a proper digestion flora and fauna.

The Pollution of Boston Harbor

Legislative action in 1935 created a special commission to investigate the discharge of sewage into Boston Harbor and to consider what change, if any, might be necessary in any of the present systems of sewerage or sewage disposal in the tributary area to prevent nuisances or remove objectionable conditions. The investigations, which were carried on during 1935 and 1936, were reported in a paper by Arthur D. Weston, M. Am. Soc. C.E., chief engineer and director of the Division of Sanitary Engineering, and Gail P. Edwards, laboratory coordinator, of the Massachusetts Department of Public Health.

The 645 sq miles of drainage area tributary to Boston Harbor contain, in whole or in part, 53 towns and cities with a total population of 1,960,000. Metropolitan Boston is served by three main sewerage systems (Fig. 1), and 95 per cent of this population reside in the three districts. Sewage from the Boston Main Drainage System, after coarse screening, is conveyed by tunnel to reservoirs on Moon Island, from which it is discharged so far as practicable on the second and third hours of the outgoing tide. The North Metropolitan Sewerage System discharges continuously, after such screening, through an outfall of multiple outlets off Deer Island, and the South Metropolitan Sewerage System terminates in three outfalls north of Nut Island.

The discharge of sewage at Moon Island has caused objectionable conditions from sleek and floating matter, as it enters the harbor at approximately the surface of the water and spreads over a large area. Large sleek areas are also produced at times by sewage from the south system and, still less frequently, by that from the north system. In order to ascertain the general condition of the harbor water an extensive program of sampling was carried out, the samples being analyzed for chemical composition, bacterial content, and quantity of dissolved oxygen. Many float tests were also made, and the extent of sleek areas was observed from boats and by means of aerial photography.

The amount of dissolved oxygen present in the harbor water during the recent investigation was in excess of that found in 1929 at all stations, and at no point in the harbor was the water found to be less than 50 per cent saturated with oxygen. The highest B.O.D. (on the outgoing tide) was 4.1 ppm. At no station did the results show that the dissolved oxygen had been depleted sufficiently to cause a nuisance. It should be noted that, because of the large amount of dissolved oxygen, the extent of pollution was indicated more accurately by analyses for free and albuminoid ammonia than by the oxygen tests.

Water in various areas was found to contain large numbers of bacteria characteristic of sewage, and samples of mud from the harbor bottom showed still higher concentrations, indicating that bacteria are deposited in the mud with sewage solids and are not washed out to sea with the outgoing tide. It appears that some of the areas now used for bathing must be adandoned unless a considerable sum is spent for treating the sewage or extending the present outlets, and for the elimination of overflows near beaches. The taking of shellfish is prohibited in parts of the harbor and restricted to taking for treatment purposes in some other parts.

There is no question of the ability of the tidal flow and the waters of the tributary streams to supply sufficient oxygen to replenish that consumed by the disposal of sewage in the harbor. Objectionable conditions can be removed if works are provided for removing certain suspended material and grease from the sewage before discharge, and by chlorination of the settled sewage should further reduction of bacteria of the coli-aerogenes group become necessary. To determine the most practicable method of treatment, experimental plants were constructed at Deer Island, Nut Island, and Moon Island. These small-scale plants consisted of fine screens, a 1,000-gal settling tank, and a 650-gal tank for pre-aeration to aid in removing grease. Large-scale experiments were also made on one of the 8,000,000-gal storage tanks on Moon Island. Results indicated that about 50 per cent of the suspended solids could be removed in a 2-hr detention period.

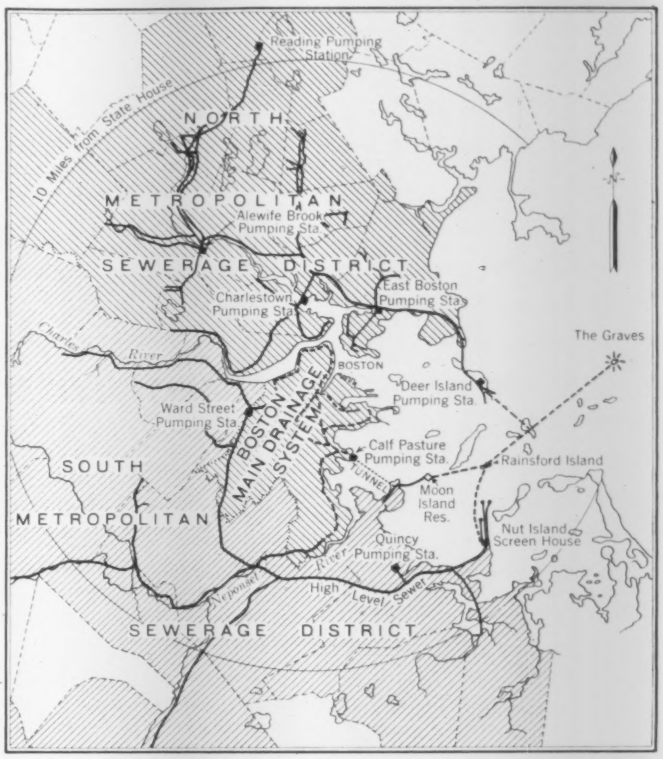


Fig. 1. Sewerage Systems in Metropolitan Boston
Dotted Lines Show Potential Tunnel Extensions of the Three Main Outfalls

Consideration was also given to the construction of an outfall sewer that would intercept the sewage from the existing main outlets and lead to a point of discharge in the outer harbor, in the vicinity of the Graves. Studies show that it would be impractical to construct such an outfall except in the form of a tunnel, the estimated cost of which is $26,100,000. And with such a tunnel constructed, it would still be necessary (as demonstrated by the float tests) to treat the sewage for removal of grease and floating matter to prevent such materials from reaching the shores.

The most economical plan appears to be to provide treatment works in the vicinity of the three main outlets (bar screens and sedimentation tanks with skimming and sludge-removal equipment); and when the treated sewage discharged from such works begins to cause objectionable conditions, to provide a program of progressive tunnel development, the initial step of which would permit the sewage to be discharged in the vicinity of Rainsford Island Sludge would be disposed of by barging to sea. The first cost of the three treatment works (not including tunnels), plus the capitalized cost of operation to 1955, is put at about $32,500,000.

Advances in City Planning

Recreational and Thoroughfare Plans Becoming Necessities for Urban Life

A NUMBER of urban problems—for example, those involving the provision of recreation outside, and easy communication inside, a city—are closely related to highway transportation. Two papers on this subject, delivered on October 7, 1937, before the City Planning Division at the Fall Meeting of the Society in Boston, Mass., are presented in the accompanying abstracts.

The opening article, by Justin R. Hartzog, answers a number of questions relating to recreational planning to serve urban populations. For example, why are metropolitan park systems necessary? What types of areas should be included? What should a regional recreation plan be like? How should regional recreation areas be designed?

Inadequate urban thoroughfares with dangerous intersections cause enormous losses in land values and time consumed in transit, Frank H. Malley points out in the second paper. The value of a comprehensive urban highway plan is illustrated in the thoroughfare plan of the city of Boston, first proposed in 1930 and now approximately one-third complete.

Recreational Planning for Urban Populations

By Justin R. Hartzog

Member American Society of Civil Engineers

City Planner, Cambridge, Mass.; Consultant, National Resources Committee, and Chief Town Planner, Resettlement Administration

PRESENT-DAY planning comes down to knowing what we are going to do with what we have, and how to obtain the things we do not have, or how to do without them and still provide a well-rounded life. This makes planning a very practical activity, an integral part of our social and economic existence. I think that engineers as a group now accept planning as an inherently sound device.

Our task in life is to create life and the elements that serve it, but we have wasted and destroyed life in the process. We have been aware of this contradictory aspect for ages, but being stupid and contrary, both as individuals and as groups, we have persisted in our shortcomings. But now, partly through enlightenment and partly through pressure—economic and social—we are tending to check the wastage of lives which are so essential to our primary objective. There are many types of planning working towards this end. An important one is recreational planning, which aims to give the individual the reserve of mental, spiritual, and physical vigor needed to meet the still far from Utopian conditions of life. To accomplish this goal, recreational planning must have many sides and employ many facilities. Large in opportunity to serve are the outdoor physical phases which bring the human being into the light and air; playgrounds, athletic fields, parks, parkways, and reservations all come in this category. Most of these facilities have existed in urban and non-urban areas for centuries, but their practical value to the population at large was relatively small until recently. Too often they were enjoyed only by the fortunate few, and the mass of the people had to seek their so-called "recreation" in unsuitable places or by trespassing.

BOSTON'S METROPOLITAN PARK SYSTEM

Present-day methods are quite different. The "commons" of New England (typified by Boston Common, established in 1634) were the forerunners in this country of public areas for outdoor pursuits. We now look upon outdoor recreation for the public as a right and not as a privilege, as a need and not as a luxury.

Out of Boston Common grew that city's parks and playgrounds of some 3,000 acres. These serve a real need in providing for sports, rest, and esthetic contemplation. As urban population grew both in Boston and in adjoining towns, each endeavored to establish adequate park areas, but a gap between recreational facilities and needs resulted nevertheless. To meet this deficiency came the Metropolitan Park system, which brought into being Revere Beach, Blue Hills Reservation, the Fellsway, and other noted facilities for the 2,300,000 people of the area. This is a planned system, which was begun in 1892 and has since been constantly studied and improved to expand its resources and preserve its unity.

Existing municipal parks are connected by parkways, and costs are borne jointly by 25 towns and 12 cities which make contributions towards the construction, maintenance, and operation of the 11,500 acres of recreation lands in the metropolitan district. In this system there are parkways, golf courses, and baseball and football fields; facilities for bathing, swimming, rowing, and their counterparts in winter sports; and also some camp-

Wellington Beach Reservation, Newfound Lake, N.H.

State Reservation, Forestry and Recreation Commission ing facilities. The Metropolitan District Commission, under whose jurisdiction these facilities are administered, also provides musical concerts in attractive and restful settings.

In the United States there are now 96 metropolitan districts having a total population of about 54,000,000 people. Most of these have recreational systems in their central city, and many have some form of metropolitan interlocking of facilities, but there are only six special metropolitan park districts in the country. In most cases major administrative difficulties must be met before recreational facilities can be developed for large numbers of people. After the municipality, the county is the next most adaptable unit for recreational development, by reason of its unity of government. It was in Essex County, New Jersey, that the first county park system was established in 1893. Today there are more than 100,000 acres of county parks (which, however, if prorated would be only about 30 acres per county), and around 65 million users.

The question why metropolitan park systems should be necessary in addition to local recreational facilities is one that frequently arises in the minds of the public, and sometimes in the minds of public administrators. We find the answer in population density and distribution, public demand, finance, land-use pattern, and physical conditions. To meet the full needs of an urban population it is usually necessary to go beyond the borders of the city itself. Boston has had a growing park system but its population would never have found all the facilities they need within its limits. The public needed bathing beaches and large open spaces. All available stretches of shore were situated in communities financially incapable of developing them for the millions living outside their own boundaries. Neither could additional large parks or reservations be established in Boston, for want of land suitable for the purpose and not subject to other conflicting needs. A consolidation of resources was necessary, and this was finally effected; out of it came facilities which the towns could not otherwise afford, and which the cities could not find within their own limits.

A Fireplace in Kemper Grove, Sharon Woods Park
Part of the Hamilton County (Ohio) Park System

The influence of expanded transportation and denser population is again changing our recreational set-up. The Boston Metropolitan Park system was begun about the time when the motor car was first coming into use. However, it has not remained a "horse-and-buggy" system, although it fortunately remains a happy one for the pedestrian. The Division of Metropolitan Planning together with the city planning boards of Boston and other cities and towns of the district, in their respective jurisdictions, has kept the planning of the metropolitan district abreast of population increases and transportation changes, so that the motorist can travel to, and enjoy recreational spots without appropriating space assigned to other uses. But, nevertheless, increasing population and new demands from a people that is becoming recreation minded show that the metropolitan and local systems are becoming inadequate.

A Typical Hiker's Shelter on Piper's Trail, Mt. Chocorua, New Hampshire
White Mountain National Forest, Administered by the U. S. Forest Service

RECREATIONAL AREAS MUST BE NEAR URBAN CENTERS

The national parks, originally viewed only by a few thousands, were last year enjoyed by over six million visitors, and the state parks by 45 million. But despite the vast improvement in motor cars, highways, and rail service, all the people cannot enjoy these delightful spots. By and large, urban populations must seek recreation nearer home—not over a day's journey away at the most. A short trip cuts the cost of travel and shelter, and most of all, fits in with the time available.

A closer-in recreational region is necessary. This is most strikingly emphasized in New York state, where the Division of State Planning reports that "less than 20 per cent of the people live outside seven metropolitan areas, and less than 6 per cent live on farms. It is essential, therefore, that large areas of common lands be provided for recreational use of the 80 per cent of the people." How large the recreational region should be, as well as where it should be located, is dependent to a large degree upon the urban population—its distribution, density, and kinds of recreation required—and the demand for land to serve other purposes. Unfortunately we have not used our lands and waters wisely in the past. Municipalities, counties, states, and the federal government are making efforts to find their way out of this chaos, by assigning land uses and controlling water resources for social and economic betterment. This is conservation of land as contrasted with exploitation of land. The National Park Service and the National Recreation Association are now making inventories of our recreational areas and facilities which should bring out many needs and shortcomings. (Data of the 1937 inventory are not available at this writing).

Aside from the mental, spiritual, and physical benefits gained by the users of recreational facilities, there is a financial benefit to the area in which such facilities are located. It is estimated that some 3,000,000 people visit New England yearly for purposes of recreation, leaving behind 300 to 400 million dollars for transportation, shelter, supplies, and other items. This emphasizes the fact that there are land requirements for private enterprise as well as for the public in connection with recreation. Naturally it is with the public aspects of the matter that we are fundamentally concerned in our regional recreation plans, although we must seek and promote coordination with private enterprise.

State parks and allied areas in the United States now have a total area of around 3,850,000 acres. This is approximately one-fourth of the area of the national parks, but in general the state parks are located much nearer to centers of population, and so have a greater recreation use. Until recently these areas were too frequently deficient in many respects—in location, size, form of development, or in cost of maintenance and operation. It is to these state parks that we must look as nuclei in our regional recreational plans. The regions of the future may be composed of one state or a group of states, depending upon geography and population density and distribution. The recreational demonstration areas initiated by the former Resettlement Administration and the National Park Service should be mentioned for their contribution, particularly as these areas (46 in number) will ultimately become state recreational properties.

What should be included in regional recreation plans? Primarily we should include all outdoor physical facilities which are not in the daily routine of recreation, for the latter are the province of the local parks and to a certain extent of the metropolitan district parks. We must care for the populace during week-ends and vacation periods. The Recreation Committee of the National Resources Committee has divided recreational areas into four classes—primitive, modified, developed, and scientific. The types of areas composing each class are indicated in Table I.

TABLE I. CLASSES OF RECREATIONAL AREAS

PRIMITIVE	MODIFIED	DEVELOPED	SCIENTIFIC
Roadless	Buffer	Observation point	Wild life
Virgin	Wild	Picnic ground	Geological
Wild life	Scenic	Camp ground	Historical
Wilderness	Parkway	Residence	Botanical
Sanctuary	Roadside zone	Resort	Archeological
Primeval	Waterfront zone	Sports	

In future, regional recreation planning must provide almost all these types of areas, but not all types will be found in all regions. For example, the primitive areas probably can be found only in some of the more remote and sparsely populated sections, but elsewhere we may hope some day to provide facilities of the modified, developed, and scientific classes. We need the picnic ground developed for a day's stop-over; the camp ground for stopping over night, for the week-end, or for a vacation period; the sports area for both summer and winter sports; the camp area where private summer camps may be developed for children and adults; the residence area to be developed like the camp area by private enterprise for private summer and winter homes; and the resort area, which is also of a commercial character.

In addition to these types we must acquire scenic areas of extraordinary beauty; observation points along highways where the motorist can pause, safe from traffic hazard, to enjoy the view; roadside zones to protect the scenic values of highways by excluding or restricting the utilization of natural resources, commercial development, or occupancy; trails, waterfront zones along lakes, ponds, streams, and other waterways; rights of way for parkways which will be entirely for recreation use, on which commercial uses are excluded, and over which abutting property has no right of light, air, or access; and areas for such scientific uses as wild-life refuges, or botanical, geological, archeological, or historical features.

The regional plan for these recreational facilities should strive for balance and coordination, and should only emphasize the individual features for which the particular region has some special fitness. These facilities need to be related to one another, so that the maximum benefits will accrue to the public.

REGIONAL PLANS FOR THICKLY SETTLED AREAS

What should a regional recreation plan be like for a densely populated section? It is assumed that the major cities and towns will meet their own local needs, and that the central city and adjoining communities will join together for coordinated functional activity through the medium of the county or a metropolitan district.

As regards the regional aspects of recreation, the state would stand out as an agency operating in a threefold capacity—first, as a partner in county or metropolitan district development or intrastate regions; second, as a provider of recreational facilities for the geographical area under its own jurisdiction; and finally as a partner, this time in conjunction with sister states, in interstate endeavors on a major regional basis. The recreational plan, then, might be generally designed to bring out the following pattern:

First, the central cities and adjacent towns would have interlocking municipal and county or metropolitan systems, all within an hour's travel-time of their residential areas. Second, there would be intrastate regional facilities for smaller urban and rural communities, in a defined geographical state sub-region, composed of somewhat limited forms of the modified and developed classes, and to a certain extent of the scientific class. These areas should be within three or four hours' travel-time from centers of concentrated population. Third, there would be state-wide facilities which might (or might not, according to the geographical and population characteristics of the state) introduce the larger and more intensive types of areas. Such facilities should preferably be not more than a half-day's travel from many of the population centers. It is possible that in some instances the state may be of such size that it may function as the region. Fourth and last, outstanding special facilities would be provided in the region through an interlocking organization of states and the federal government. These facilities would necessarily be situated throughout the region in their natural locations, but it is desirable that they should be not more than a day's travel for the average family from urban centers. Obviously, these facilities will overlap both physically and functionally, and will have to be adjusted in size and arrangement.

In selecting sites for these facilities, the following characteristics will govern:

1. Adaptability of the site for the desired purpose.
2. All-around adequacy to meet its functions.
3. Accessibility to the mass of the urban population.
4. Reasonableness of cost in capital investment, maintenance, and operation.
5. Degree of coordination possible with the development of other regional and local activities.

While regional recreational planning will look towards the provision of parkways as an integral part of its organization, there is need now for close coordination with existing highway systems and with regional and state-highway plans. A great deal of the present congestion of highways and streets in urban communities can be eliminated by giving the recreational traffic the routes which it seeks, and maintaining those routes, as to use and character, for recreation.

Finally, how should recreational areas be designed? In this connection we must remember the original goal—the creation and restoration of mental, spiritual, and physical vigor. Design plans must be simple in character and well rounded, but they must have sufficient definiteness to provide the specific types of recreation sought. The actual design, therefore, requires the closest collaboration between landscape architects, engineers, and architects, to create facilities that will be fully adequate for their purpose without spoiling the natural setting.

Thoroughfare Plans and Urban Areas

By Frank H. Malley
Associate Member American Society of Civil Engineers
Acting Secretary, Boston City Planning Board, Boston, Mass.

THERE is sufficient evidence to place transportation in the class of big business, and no doubt it stands at the head of its class. The investment in railways, pipe lines, and waterways in this country is now about $30,000,000,000. When to this there is added the cost of highways, together with the value of 28,000,000 motor vehicles registered in 1936, the total assumes such astronomical porportions that an accurate analysis is impossible.

This transportation system of ours moves about 350 billion ton-miles of freight per year, about 10 per cent of which is carried over the highways. In the case of passenger transportation, however, more than 90 per cent of the 380,000,000,000 passenger-miles total is performed by private automobiles. In the aggregate, this is equivalent to 2,500 miles of travel annually by every man, woman, and child in the country, each accompanied for the entire distance by at least a ton of freight.

The highway network is a large factor in our existence and welfare, and forms the backbone of our civilization. The planner must be the orthopedic surgeon who puts these bones in proper interrelation and keeps them there.

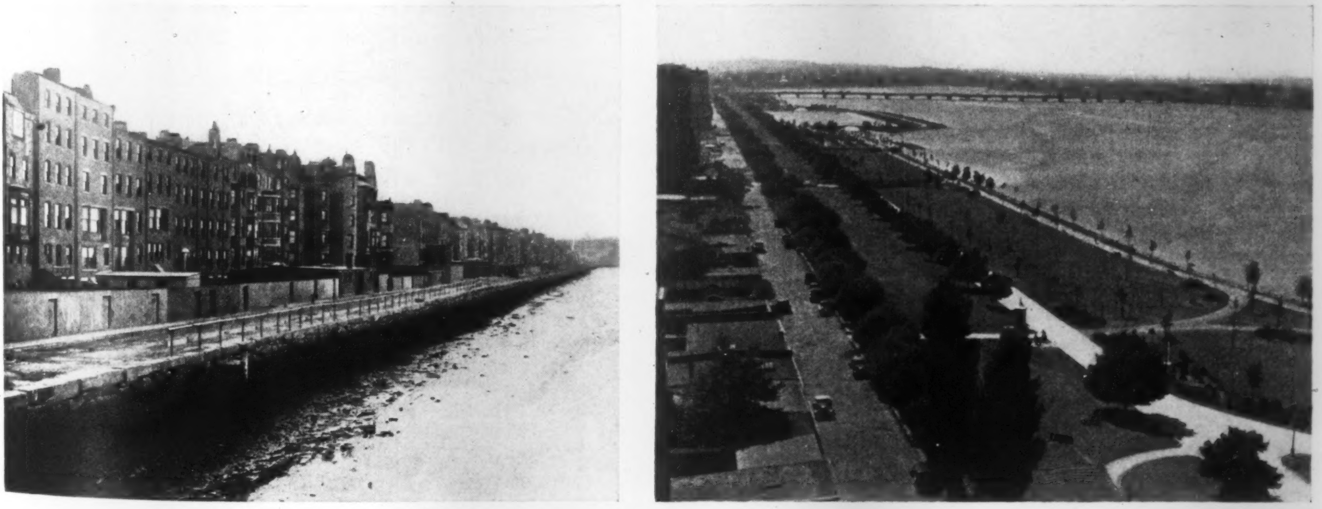
The immediate function of a highway is to provide free circulation of traffic. Such traffic is made up of all types of vehicles traveling in all directions for both business and pleasure. This in itself indicates that a comprehensive plan is not only of value but is downright indispensable. The development of technique in the planning of streets and highways has led to the consideration of topography, population distribution, and numerous kinds of traffic counts. These factors are all very well as far as they go, but other important items should be given consideration.

BETTER DESIGN OF HIGHWAYS NEEDED

"Built-in" safety in streets and highways will be an important means of lessening the mounting toll of motor-vehicle accidents. Stringent regulations can be adopted, and an honest effort can be made to enforce them, but until the dangerous features of our streets and highways are corrected, careless and foolhardy drivers will continue to swell the number of accidents, which have increased from 4,227 throughout the United States in 1913 to 30,000 in 1930, and to 37,800 in 1936.

Tremendous strides have been made in the designs of highways in recent years, but automotive engineers have made still greater progress in motor-vehicle design. Are our present motor vehicles then too good for our roads, or are our roads too poor for our vehicles?

Unquestionably the public does not want the efficiency of its cars and trucks reduced, and unquestionably the construction of safe roads is expensive—the railroads have been through all that—but the expense is small compared with the value of the lives lost through unsafe road conditions, and the resulting tremendous cost of congestion and delay.

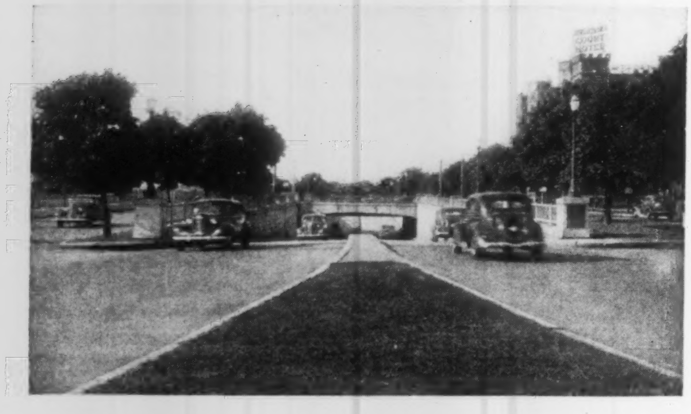


A Photograph Taken in 1904

After Completion of the Development in 1934

Two Views Along the Charles River Basin, Boston, Mass., Taken from About the Same Point

It is axiomatic that traffic can move no faster than its speed at intersections. It is also true that a highway is no safer than its intersections. At the end of many wide streets bringing traffic from one district to another, there is no provision for the absorption of such traffic. In fact, every intersection along the route is a source of danger. Intersections that appear dangerous are often the safest, as motorists proceed more cautiously through them. The most hazardous ones are those which, although dangerous, appear to be safe. These intersections need most careful study to determine the causes of danger and the most effective means for their removal. More and more the realization is being driven home to us that superhighways and freeways are a necessity, not a luxury.



MEMORIAL DRIVE PASSES BENEATH MASSACHUSETTS AVENUE AT CAMBRIDGE, MASS.

SOLVING THE PROBLEM OF LAND USE

Another factor that should be given considerable weight in the planning of highways is land use. The ultimate objective of a transportation system is to promote proper and adequate use of land. Land uses may be boiled down to comparatively few categories, such as industry, business, housing, agriculture, and recreation, each of which places different burdens on the transportation system. Some of the corresponding kinds of traffic can be consolidated and some must be segregated if economy and ease in doing business are to be maintained.

Traffic between centers of congestion can readily be accommodated on properly designed superhighways built to carry both slow and fast vehicles, whether bent on business or pleasure. There exists no economic justification for expensive construction for trucking arteries in addition to highways for general traffic. It is, however, feasible to construct parkways for the exclusive use of passenger vehicles. This fact is borne out by the transportation figures quoted previously.

Vehicles moving between residential and shopping districts should not be merged with through traffic attempting to get to the other side of the town, and traffic serving heavy industrial areas should not be forced to mingle with either within city limits. I emphasize these elementary facts only to make my main point in regard to land use.

A comprehensive thoroughfare plan is one of the few effective instruments we have for the stabilization of land values. The home owner should be assured that his peace and quiet will not be disrupted by unexpected traffic congestion in his neighborhood. Stores need quick delivery of goods. For example, a store learns from weather bureau reports that the following day is to be stormy. An order may be placed for immediate delivery of rubbers, umbrellas, and raincoats for a sale on the rainy day. Only by well-planned motor transportation can such rapid delivery be made. Service of this sort decreases the amount of stock on hand, with it consequent investment, and further, cuts down the amount of warehouse space required.

Even for a large city, $100,000,000 is a large amount to spend for a highway program, but how much more is being lost through lack of a comprehensive program in such items as real estate value and time of transit (especially for trucks) owing to congestion on traffic arteries!

HIGHWAY PLANNING NO NEW THING IN BOSTON

Master highway planning is not new to Boston. As far back as 1629 Thomas Graves was sent from Kent, England, to Charlestown to "model and lay out the form of the town with streets about the hill," providing for each inhabitant a two-acre plot to plant upon. Overcome by sickness, grief, hunger, and lack of fresh water, the little group was soon forced to abandon the original settlement for a more favorable location on the other side of the Charles River "at a place called Trimountaine," and the plan for Charlestown was of necessity abandoned. Again in 1844 Robert Fleming Gourlay published a comprehensive plan for Boston and endeavored to have it accepted by the city. The South Boston district was also developed as the result of a carefully prepared plan in the early part of the last century. Still another area of the city—the Back Bay district—was built upon a plan prepared when the Commonwealth reclaimed the area about 1850.

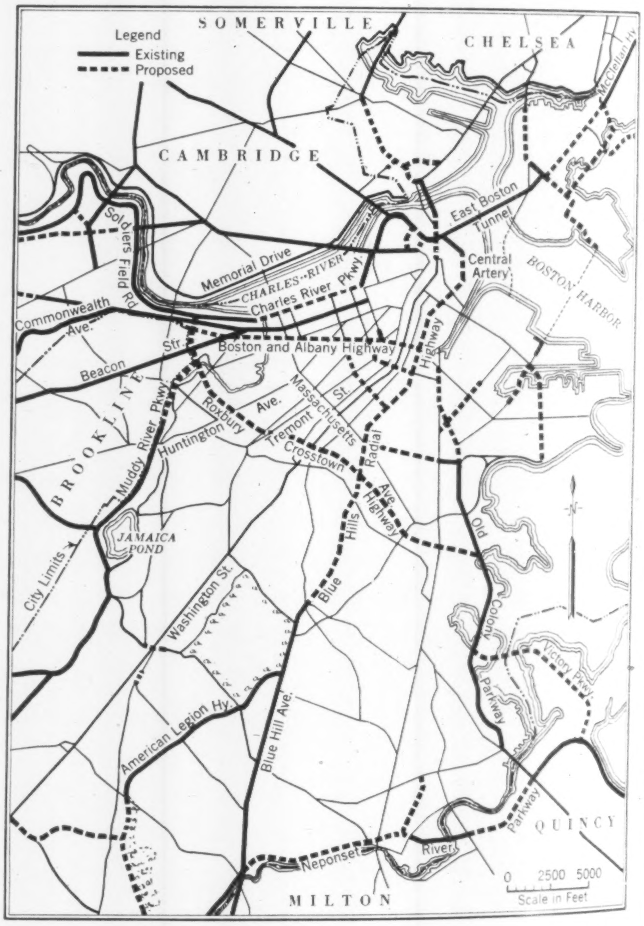

Legend
Existing
Proposed
SOMERVILLE
CHELSEA
McClellan Hy
CAMBRIDGE
Soldiers Field Rd
Memorial Drive
CHARLES RIVER
Charles River Pkwy
East Boston Tunnel
Central Artery
BOSTON HARBOR
Commonwealth Ave.
Beacon Str.
Boston and Albany Highway
Highway
BROOKLINE
Muddy River Pkwy
Roxbury Ave.
Huntington
Massachusetts St.
Tremont
Crosstown
Radial
Ave.
Highway
Blue Hills
JAMAICA POND
City Limits
Washington St.
Old Colony Parkway
Victory Pkwy
American Legion Hy.
Blue Hill Ave.
Parkway
QUINCY
Neponset River
MILTON
N
0 2500 5000
Scale in Feet

FIG. 1. STATUS OF THOROUGHFARE CONSTRUCTION IN BOSTON

It should be borne in mind that the Boston Metropolitan area is shaped like a piece of pie—the large one that is left after the first piece is removed. This missing piece consists of Boston Harbor, which, as far as thoroughfares are concerned, is a considerable liability. Traffic moving between points north and south of the central city has only one choice in by-passing the congested central district, that of going to the west of the city. This is of particular importance in considering that our beaches are along the waterfront, extending northeast and southeast from the city. These beaches accommodate upwards of half a million people at one time.

THOROUGHFARE PLAN AND ITS CONSTRUCTION PERIODS

In 1930 the City Planning Board presented to the public its report on a thoroughfare plan for Boston (Fig. 1), developed during the previous four years under the direction of the late Robert Whitten as consultant. This articulated plan covers over seventy elements of thoroughfare improvement having a total cost of approximately $90,000,000. This is a small amount to pay for such a permanent improvement when it is considered that in traffic congestion alone Boston is losing 20 per cent of this amount per annum. When to this is added the loss in tax value created by the inability of real-estate owners and tenants to do business efficiently, it is impossible to justify any serious attacks upon the plan.

The program set up for the development of these improvements was divided into four construction periods. The first period contains those projects which were considered most necessary for immediate completion to eliminate the worst conditions. The second period includes improvements of secondary importance, and so on to the fourth construction period, providing for projects also proved to be important but which can reasonably be deferred longest.

In terms of dollars spent, the first construction period is more than half completed. One small project assigned to the second construction period has been completed, and five items of the third construction period have been partially or wholly finished.

About $30,000,000 of the $90,000,000 has been spent in creating traffic improvements substantially in accordance with the plan.

WHAT THE COMPREHENSIVE PLAN INCLUDES

The backbone of this comprehensive plan is a series of express arteries extending from the south to the north of the city. These arteries are designed not only to act as feeders to the city itself but also to carry through traffic between points to the north and south. It was intended that traffic following U. S. Route 1 across Massachusetts would be directed through these express ways. This chain of arteries comes into the city from the south along the Neponset River Parkway now under construction. At about its middle point it will connect with the Canterbury Parkway, the northern half of which is completed and has been named the American Legion Highway. The third link in the chain is a short one extending along the existing Blue Hill Avenue and connecting with the proposed Blue Hills Radial.

All these thoroughfares are from 100 to 140 ft in width, and with the exception of Blue Hill Avenue, all have center strips, segregating inbound and outbound traffic. The Blue Hills Radial will lead into downtown Boston to connect with the Central Artery, about one-third of which is completed. The Central Artery roughly parallels the waterfront, by-passing the heaviest congestion. This is designed to include an elevated roadway carrying six lanes of express traffic. It passes, and connects with, the southern end of the East Boston Tunnel which has been in operation about three years. The McClellan Highway will eventually connect the East Boston end of the tunnel with Route 1 as it now exists. This terminal link of the chain is already two-thirds completed.

Weeks Memorial Bridge, Charles River Basin, Boston

During the past year the Massachusetts State Planning Board has developed a master highway plan for the state which includes a freeway extending northeast across the eastern part of the commonwealth. Upon completion, this will assume the burden of the Atlantic Coastal Highway and will relieve Boston thoroughfares of a large amount of traffic. It does not alter the structure of the Boston plan, however, as the proposed development will be necessary to accommodate the large volume of semi-local traffic moving into, out of, and through the city.

Other radial arteries of importance include the Old Colony Parkway extending from South Boston along the waterfront to the southern boundary of the city, where it connects with other boulevards along the shore through Quincy. This parkway has a 100-ft width with a single 40-ft pavement, and for most of its length is adjacent to salt water. This is in effect a freeway, for there is limited access to the pavement between South Boston and its southern terminus. It serves a dual purpose in carrying the bulk of the traffic between Boston and points to the south, and in serving the southern beaches. A bill is now before the legislature to modernize this artery by adding another pavement to provide six lanes of moving traffic with a center strip, an improvement sorely needed although this parkway is only a little over ten years old.

Two other radial thoroughfares are recommended to connect downtown Boston with points to the west. The first, which is entirely utilitarian, consists of decking over the Boston and Albany Railroad tracks, with an elevated roadway connecting the Central Artery with a point well out on Commonwealth Avenue. This development must be deferred pending some form of electrification of the railroad.

The second artery is in the nature of a parkway along the only section of the Charles River Basin within the city limits not now so serviced. This parkway will adjoin the Back Bay district and extend from Embankment Road in the downtown area out to Soldiers' Field Road in Brighton. It is designed as a freeway with depressed pavements in order not to detract from the high type of the neighborhood and provide a rapid means of handling a great mass of rush-hour traffic. The planting is designed to screen the artery from the land side and at the same time enable motorists to enjoy the beauties of the Basin, the largest expanse of water of this sort in America. The Basin, with one small exception, will then be entirely surrounded by driveways at the water's edge, graded and planted as a park with the splendid façades of Harvard University and the Massachusetts Institute of Technology as backdrops.

These radials will relieve the older streets such as Washington, Shawmut, Tremont, Huntington, Commonwealth, and Beacon, all radiating from the hub like the spokes of a wheel, and all carrying their share of traffic.

BOAT LANDING ON CHARLES RIVER BASIN, BOSTON, BUILT IN 1934

Boston has many circumferential streets leading from the Charles River basin across the peninsula to the waterfront and South Boston. Massachusetts Avenue is the principal in-town circumferential, connecting Cambridge with South Boston and points south. One major circumferential, the Roxbury Crosstown, is included in the Thoroughfare Plan. This is to be a wide express highway, with adequate grade separations at all important intersections, extending from Old Colony Parkway through the Roxbury district to Cottage Farm Bridge.

What is the value of this comprehensive plan, on which a substantial amount of money has been expended? It is well known that master plans have no weight unless they are given a legal status. Legislation has been passed permitting this master plan to become official, but the change has never been effected.

Previous to the completion of this plan the city was expending about $10,000,000 a year for new streets and street widenings. Rugged individualism guided this expansion, and little analysis was made of the effects one street might have on the remaining 750 miles of streets in the city, to say nothing of the effect on property values. For a considerable expenditure, there was small tangible gain, because errors were made in alinement or width which later had to be corrected or else endured.

Traffic congestion is a disease which affects the financial as well as the social structure of a community. An example of this has already been discussed. Another was brought out by a recent study made of the proposed Central Artery circumscribing Boston's business district. Owing to a reduction of values in the district, the present estimate of the improvement is 30 per cent less than that made in 1930, only seven years ago. One may say that this is due to the depression, and no doubt some part of it is, but there is no reason except congestion that would account for the fact that this area has depreciated so much more than other areas where traffic movement is comparatively free.

With an adequate transportation system, congestion can be further relieved by decentralization of population. Housing experts advance innumerable social and economic reasons for a reasonable degree of decentralization. Considering that the state of Kansas is large enough to house the entire population of the world at a reasonable density of ten families to the acre, there is little reason for crowding people into unsanitary, congested areas, that breed slums and delinquency—the most extravagant vices in which a city can indulge itself.

Decentralization in Boston is needed only within the city limits. If the total population were moved into those areas zoned for residential use only, the density would amount to only 12 families to the acre, and 40 per cent of the city's area would remain for business and industry. This is in spite of the congestion—200 families per acre—now existing in one small area in the North End.

Land values should be adjusted to use rather than use adjusted to values. But economy of land use is possible only if such use is based upon a plan. It can properly be claimed that a well-balanced, articulated thoroughfare plan will reduce slum conditions and prevent their spread in addition to stabilizing land values and uses. By this means the cost of traffic congestion can be greatly reduced and the appearance of the city visibly enhanced—no small factor in inducing people to live and do business in a community.

The metropolitan highway system restricted to pleasure vehicles consists entirely of parkways connecting with, and running through, metropolitan parks. It is therefore necessary to consider not only the transportation function of the system but also the important function of recreation.

The design of this system of parkways was carefully worked out by the Division of Metropolitan Planning and is coordinated with the thoroughfares of Boston and the other 42 cities and towns which comprise the metropolitan district. Not only are these parkways efficiently designed but they are attractively landscaped and remarkably free from billboard atrocities. The Boston and the Metropolitan park systems augment and supplement each other to an extent such that it is impossible to divorce the two.

The Boston Park system comprises over 3,000 acres, about 10 per cent of the area of the city, including 118 acres of water parks, two 18-hole golf courses, and ten bathing beaches—at a capital cost of over $33,000,000. This is augmented by 11,044 acres of parks in the Boston metropolitan district under the jurisdiction of the Metropolitan District Commission—representing an additional investment of $30,000,000 within the city of Boston.

RECREATION A MAJOR INDUSTRY

Recreation is the second largest industry in Massachusetts, with an income estimated by the New England Council at $200,000,000 a year. This is due in large measure to the natural resources of topography and climate with which the commonwealth is endowed. Park systems were established to protect these natural beauty spots and dedicate them to the use and benefit of the public for all time. Consequently a very intimate relationship exists between the parks and the parkways serving them. One example of the need for close articulation of the transportation and park systems lies in the fact that the beaches adjacent to Boston often accommodate over half a million people at a time. The problem of transporting such a number over the road would be tremendous even if they were regimented with definite speeds, routes, and destinations. When this mass of humanity is broken into its component families moving helter skelter in all directions, the problem is indeed acute.

From a recreational point of view these parkways have two functions—that of recreation per se through motoring, and the more important function of transportation to and from park and recreation areas.

The social and economic value of such parks is indicated by the volume of the business they bring to the communities and is emphasized by the tremendous amount of free or inexpensive recreation they afford. This becomes even more important with current increases in leisure time. Economy in the development and use of such large interdependent activities of a community is possible only if they are based upon a comprehensive plan.

ENGINEERS' NOTEBOOK

From everyday experience engineers gather a store of knowledge on which they depend for growth as individuals and as a profession. This department, designed to contain ingenious suggestions and practical data from engineers both young and old, should prove helpful in the solution of many troublesome problems.

Basic Formulas for Combined Flexure and Direct Stress

By Francis P. Witmer, M. Am. Soc. C.E.

Director, Civil Engineering, University of Pennsylvania, Philadelphia, Pa.

FOR problems involving combined flexure and direct stress, the general formulas discussed here are very convenient. They are not claimed as original, but in their general forms they are not familiar to most engineers, and their ready applicability to the solution of problems of this type seems to justify their presentation. They avoid the necessity of further application of the principles of differential equations which arise in the solution of such problems. From Eq. 1 are readily derived Euler's formula and the secant formula for eccentrically loaded columns. From Eq. 2 may be derived the fundamental equation for deflection which is the basis of the deflection method of analysis for suspension bridges (see *Modern Framed Structures*, by Johnson, Bryan, and Turneaure, 9th edition, Part II, p. 253, Eq. 4).

The formulas in question are:

For combined compression and bending [Fig. 1 (*a*) and (*b*)]:

$$y = A \sin nx + B \cos nx + \frac{X}{P} - \frac{d^2X}{n^2 P\, dx^2} \qquad [1]$$

For combined tension and bending [Fig.1 (*c*) and (*d*)]:

$$y = Ae^{nx} + Be^{-nx} - \frac{X}{T} - \frac{d^2X}{n^2 T\, dx^2} \qquad [2]$$

In these equations, $n = \sqrt{\frac{P}{EI}}$ or $\sqrt{\frac{T}{EI}}$; X is the bend-moment at point (x, y) due to transverse loads, or any other moment which is not a function of the deflection y; e is the base of the Naperian system of logarithms, and A and B are constants of integration, to be determined from known conditions. A simple demonstration of the equations follows.

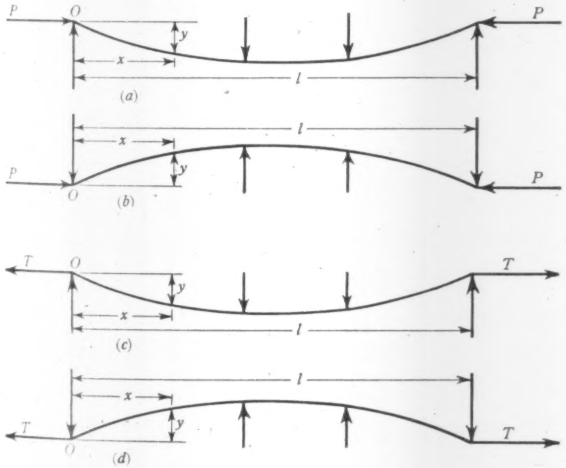


FIG. 1. CASES OF COMBINED FLEXURE AND DIRECT STRESS

For cases (*a*) and (*b*), Fig. 1, when P is varied by a differential increment, the quantities Py and $\frac{d^2y}{dx^2}$ will vary in opposite directions, one increasing algebraically as the other decreases. For cases (*c*) and (*d*), when T is varied by a differential increment, the quantities Ty and $\frac{d^2y}{dx^2}$ will vary in the same direction, both increasing or decreasing algebraically at the same time. The foregoing will readily appear by consideration of the form of the respective curves. Thus, generally, for compression and bending,

$$M = -Py + X \qquad [3]$$

and for tension and bending,

$$M = +Ty + X \qquad [4]$$

In general, $\frac{d^2y}{dx^2} = \frac{M}{EI}$. Hence from Eq. 3,

$$\frac{d^2y}{dx^2} = -n^2y + \frac{X}{EI} \qquad [5]$$

and from Eq. 4,

$$\frac{d^2y}{dx^2} = +n^2y + \frac{X}{EI} \qquad [6]$$

These are the basic differential equations which require solution for compression and bending and for tension and bending, respectively.

First consider that X equals zero. Then Eq. 5 becomes

$$\frac{d^2y}{dx^2} = -n^2 y \qquad [7]$$

and Eq. 6 becomes

$$\frac{d^2y}{dx^2} = +n^2 y \qquad [8]$$

In order that Eq. 7 may be true, y must be such a quantity that its second derivative is equal to the quantity itself, with the opposite sign. This is true of only two quantities, the sine and the cosine. Hence the integration of Eq. 7 must be

$$y = A \sin nx + B \cos nx \qquad [9]$$

where A and B are constants of integration. In order that Eq. 8 may be true, y must be such a quantity that its second derivative is equal to the quantity itself with the same sign. This is true of only two quantities,

e^x and e^{-x}. Hence the integration of Eq. 8 must be

$$y = Ae^{nx} + Be^{-nx} \quad \ldots\ldots\ldots\ldots [10]$$

where A and B are constants of integration.

Let us now consider the term containing X in Eq. 5. From this equation we may write

$$\frac{d^2y}{dx^2} = -n^2y + \frac{n^2X}{P}$$

whence $$y = \frac{X}{P} - \frac{d^2y}{n^2\,dx^2} \quad \ldots\ldots\ldots\ldots [11]$$

Hence $$\frac{d^2y}{dx^2} = \frac{d^2X}{P\,dx^2} = \frac{d^4y}{n^2\,dx^4}$$

The highest possible power of x in any term of the bending moment X from any system of transverse loads is the second, in which case $\frac{d^4y}{n^2\,dx^4}$ becomes zero, and we may therefore write, from Eq. 11,

$$y = \frac{X}{P} - \frac{d^2X}{n^2\,P\,dx^2} \quad \ldots\ldots\ldots\ldots [12]$$

Equation 1, the complete integral of Eq. 5, follows from Eqs. 9 and 12. This is the equation of the elastic curve between the origin and the point (x, y) for cases such as (*a*) and (*b*) in combined compression and bending.

By operating on Eq. 6 in precisely the same manner, we obtain

$$y = -\frac{X}{T} - \frac{d^2X}{n^2\,T\,dx^2} \quad \ldots\ldots\ldots\ldots [13]$$

From Eqs. 10 and 13 the complete integration of Eq. 6 is as given in Eq. 2. This is the equation of the elastic curve between the origin and the point (x, y) for cases such as (*c*) and (*d*) in combined tension and bending.

In writing the value of X, care must be taken to give to each term an algebraic sign consistent with its direction of rotation as compared with the direction corresponding to the term n^2y. Thus, for cases (*a*) and (*b*), since n^2y in Eq. 5 is negative, any term which represents a moment in the same direction as Py will be negative. In (*c*) and (*d*), any term which represents a moment in the same direction as Ty will be positive.

Wherever an abrupt change in the loading condition occurs, there will exist a point of tangency between two elastic curves of the form of Eq. 1 or 2, each having two constants of integration such as A and B. The entire member, therefore, may comprise two or more elastic curves with two constants for each, all of which must be evaluated. This is done by usual methods, assigning values for x and y, or for x and $\frac{dy}{dx}$, which are known to be true for certain special conditions. Substituting the computed values of these constants in the various elastic curve equations, the true value of y at any point can be obtained, and the bending moment at the same point will follow from Eq. 3 or 4.

Equation 2 may be expressed in terms of hyperbolic functions, thus:

$$y = A'\sinh nx + B'\cosh nx - \frac{X}{T} - \frac{d^2X}{n^2T\,dx^2} \quad \ldots [2a]$$

It is interesting to note the similarity between Eqs. 2a and 1.

In using Eq. 1, quantities nx must be multiplied by $180°/\pi$ to transform them into degrees before evaluating the trigonometric functions. Further, the moment of inertia I must be assumed constant throughout the length l.

As an example of the practical application of these formulas, consider a beam loaded as in Fig. 2. Equation 1 is applicable, and

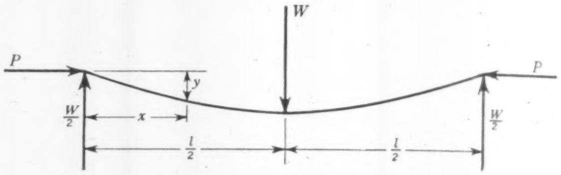


FIG. 2. CONDITIONS ASSUMED IN EXAMPLE

$$X = -\frac{Wx}{2};\quad \frac{X}{P} = -\frac{Wx}{2P};\quad \frac{d^2X}{n^2P\,dx^2} = 0$$

When $x = 0$, $y = 0$, and therefore $B = 0$. When $x = \frac{l}{2}$, $\frac{dy}{dx} = 0$. But $\frac{dy}{dx} = nA\cos nx - \frac{W}{2P}$. Hence

$$A = \frac{W}{2nP\cos(nl/2)},$$ and Eq. 1 becomes

$$y = \frac{W\sin nx}{2n\,P\cos(nl/2)} - \frac{Wx}{2P}.$$

Substituting in Eq. 3, $M = -\frac{W\sin nx}{2n\,P\cos(nl/2)}$. The maximum moment, occurring at $x = \frac{l}{2}$, is $-\frac{W\tan(nl/2)}{2n}$, a familiar form.

Computing Maximum Moments from Moving Loads

By WILLIAM POPPER, JUN. AM. SOC. C.E.
JUNIOR BRIDGE ENGINEER, WITH STATE OF CALIFORNIA, SACRAMENTO, CALIF.

THE maximum moment at any given point on a span, produced by a standard system of concentrated moving loads, can be determined quickly and accurately by the method described here. No new principles are involved, the advantage of the method lying in the fact that once a table similar to Table II is developed for a given system of loads, it is applicable to any simple span of sufficient length to accommodate the loads in the critical position for the point that is under investigation.

Referring to Fig. 1, the criterion for maximum moment at P is: A load at P, and

$$\frac{W_L}{W} = \frac{L - x}{L} \quad \ldots\ldots\ldots\ldots [1]$$

in which W is the sum of all the loads, and W_L the sum of all the loads to the left of P. For the standard system of wheel loads, the value of W_L/W is computed at each wheel (Fig. 2). The loads are then reversed and the computation repeated (Fig. 3). Values of W_L/W greater than 0.500 are of course of no value.

Referring again to Fig. 1 and to Eq. 1, it will be seen that by selecting a value of W_L/W closely approximating the given value of $(L - x)/L$, a critical wheel is thereby placed at P. In practice, the moment corresponding to one value of W_L/W on each side of the actual value of $(L - x)/L$ would be computed, the greater being the maximum sought.

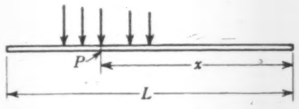


Fig. 1. Beam with Moving Loads

Line d of Figs. 2 and 3 is the distance from each wheel to the center of gravity of all the loads. Hence $(x + d)$ is the distance from the right support to the center of gravity of all the loads, when the value of d corresponding to the wheel at P is used. The left reaction now becomes $30(x + d)/L$, and the moment at P is

$$M_P = 30(x + d)\,\frac{L - x}{L} - m \ldots\ldots\ldots\ldots\ldots [2]$$

in which m is the moment, about P, of all loads to the left of that point. Values of m are also shown in Figs. 2 and 3.

The values of W_L/W, d, and m, from Figs. 2 and 3, are collected in Table I—values of W_L/W being placed under the heading $(L - x)/L$—and the method is ready for use.

For example, given a simple span of 300 ft. Wanted, the maximum moment at a point 100 ft from one end caused by the loads shown in Figs. 2 and 3:

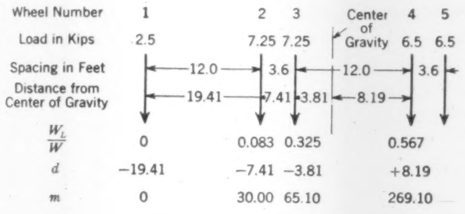


Fig. 2. Tabulation of Computations

Solution, $(L - x)/L = 0.333$. Opposite 0.325 in the first column of Table I, find $d = -3.81$ and $m = 65.10$. Then, from Eq. 2, $M_P = 30(200 - 3.81)(0.333) - 65.10 = 1{,}897$ ft-kips. Similarly, using the values opposite 0.433, $M_P = 1{,}859$ ft-kips. Hence the maximum moment sought is 1,897 ft-kips.

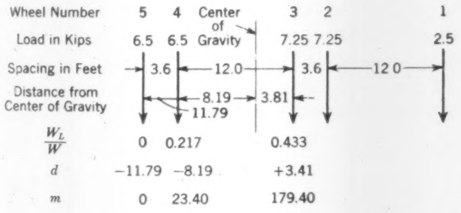


Fig. 3. Tabulation of Computations, Loads Reversed

A table similar to Table I can be made up for any given system of concentrated loads, and Eq. 2 is valid provided the total weight of the given system is substituted for the factor (30) used in this example.

A further simplification of the method eliminates all "cut and try" in the selection of the critical wheel. By plotting M_P against $(L - x)/L$ for each wheel in turn, a straight line is obtained for each wheel. (In making the computations for this plotting, the quantity x is held constant at a convenient value, say 100 ft, while L is varied.)

Table I. Values of d and m for Use in Eq. 2

$(L - x)/L$	d	m
0	−11.79	0
0.083	− 7.41	30.00
0.217	− 8.19	23.40
0.325	− 3.81	65.10
0.433	+ 3.81	179.40

Table II. Modification of Table I to Eliminate Trial Solutions

Range of $(L - x)/L$	d	m
0 to 0.228	−11.79	0
0.228 to 0.325	− 7.41	30.0
0.325 to 0.500	− 3.81	65.1

By using only the upper limiting broken line thus produced, and computing the location of the breaks, the actual limiting values of $(L - x)/L$ for each wheel are obtained. As a result, Table I can be replaced by Table II, a more definite form.

A Handy Slide-Rule Shortcut

By William E. Davidson, Jun. Am. Soc. C.E.
Senior Foreman Engineer, National Park Service,
Piedmont, Calif.

THE following simple method of obtaining the square root of the sum (or difference) of two squares on a slide rule does not seem to be generally known among engineers. The method is not original with me, but it has proved such a time-saver that I wish to pass it on to others.

The general equation, $z = \sqrt{x^2 + y^2}$ can be written as $z = y\sqrt{(x/y)^2 + 1}$, in which form it can be solved quickly and accurately on any slide rule having the ordinary A, B, C, and D scales. For convenience it is better to make the fraction x/y greater than one; that is, always divide the larger number under the radical by the smaller, and place the smaller outside.

To solve, divide x by y on the C and D scales. The square of this quotient is on the A-scale above the index on the B-scale. Add 1 to this square by moving the slide to the right. The answer, z, can now be read on the D-scale below y on the C-scale. (By the last step we have taken the square root of $(x/y)^2 + 1$ and multiplied it by y.)

For example, let us solve $\sqrt{35.3^2 + 20.6^2}$. After dividing 35.3 by 20.6 on the C and D scales, read its square, 2.94, on the A-scale above the index on the B-scale. Move the slide to the right until the B-scale index is below 3.94 (that is, 2.94 + 1) on the A-scale. Read the answer, 40.9, on the D-scale below 20.6 on the C-scale.

Of course, when solving for the square root of the difference of two squares it is necessary to subtract 1 from the fraction $(x/y)^2$, instead of adding it—that is, move the slide to the left instead of to the right.

OUR READERS SAY—

In Comment on Papers, Society Affairs, and Related Professional Interests

Need for Extending Mapping Program of United States

To the Editor: At the recent Fall Meeting of the Board of Direction in Boston a resolution was adopted citing the favorable attitude of the Board towards extension of the topographic mapping program of the United States, commending the report by Secretary Ickes theretofore published as Senate Document 14 of the 75th Congress, 1st Session, and bringing the matter to the attention of Local Sections and the membership generally. If, during the next few months, Local Sections and individual members of the Society will actively support the efforts of William Bowie, M. Am. Soc. C.E., chairman of the Surveying and Mapping Division of the Society, to secure adoption of this program by the next Congress, there is every reason to hope for success.

Secretary Ickes has well pointed out that the United States is far behind other civilized countries in the matter of topographic mapping and calls attention to the fact that, "Those engaged in municipal and general planning, in the development of power and irrigation enterprises, in erosion control, in mining developments, in forest and park administration, and in such developments as those in Tennessee Valley, are insistent that these maps be prepared promptly as essential basic engineering material, without which general studies and planning activities are severely handicapped." The National Board of Surveys and Maps, in its report of October 29, 1934, to the National Resources Board, declared that a base map of the entire area of the United States is a national need and that the actual loss of money due to the lack of adequate maps is greater than the estimated cost of completing such maps. There is evidently sympathetic leadership in the Senate which called for the Ickes report. What is most needed now is activity on the part of civil engineers, which will give practical effect to their wishes in the matter.

The Sacramento Section has attempted to give such practical effect to its wishes by appointment of a Committee on Surveying and Mapping. Letters commending the Ickes mapping program have been sent to the President, to Secretaries Ickes and Roper, to the two United States Senators from California and local Congressmen, to the State Planning Board, to the State Chamber of Commerce, to local county boards of supervisors, and other organizations. As a result, the State Planning Board, the State Chamber of Commerce, and local boards of supervisors have in turn addressed letters to California's congressional delegation, favoring adoption of the Ickes program. If other Sections would pursue a similar course, the combined effect upon Congress should be productive of results.

Everett N. Bryan, M. Am. Soc. C.E.
Chairman, Committee on Surveying and Mapping, Sacramento Section, American Society of Civil Engineers

Sacramento, Calif.
October 23, 1937

Oddities of Right of Way

To the Editor: Some of the curious things I have encountered in right-of-way work may be of interest to your readers. In Illinois, a landowner complained that the Santa Fe Railway trespassed on his property, and a careful measurement showed that he was right. The matter was settled by having the telegraph lineman saw eight inches from the ends of the cross-arms of three telegraph poles!

A right-of-way agent for the "Cotton Belt" road, on a Texas branch, tried to save (his own) time by writing descriptions reading, "a right-of-way one hundred feet in width across my land where I now live." If any question ever arose, county records would have to be searched to find where he lived at that particular time. Some older deeds read "one hundred feet wide in timbered land and sixty feet wide in cultivated land"—another legacy of search.

When the St. Louis and San Francisco Bridge over the Arkansas River was completed in 1885, and the track laid to Fort Smith some four miles away, one man located about halfway between the two towns, claimed he had not been paid for his right of way. He produced his deed, in which the land was described as "beginning one hundred and fifty feet from the (something like SW. corner of the SW quarter) corner; no distance given. Thence in the direction of Fort Smith. . . .ft." Fort Smith covered about one and one-half miles east and west! He really had some visible land, did not claim much, and was paid a few dollars.

The story is told of a former attorney of the St. Louis and San Francisco, who on one occasion dickered for some time with a widow for a little piece of right of way without being able to reach an agreement. Finally he grew tired and said, "Madam, as we cannot agree I will be under the painful necessity of condemning your land." He then got up on the fence, took off his hat, and began, "Oh yes, oh yes, I hereby, through the authority in me vested, condemn this said right of way for the use and benefit of the Saint Louis. . ." At this point the woman cried, "Stop, stop! I'll take what you offered sooner than lose my farm."

In Bell County, Kentucky, setting stakes for grading on the Louisville and Nashville was stopped by a half dozen or so neighbors. The right of way had not been paid for, and the leader said they had been told that if all the stakes were set before payment, the company could take the property. There was no use arguing, especially as they all had rifles. However, they had become acquainted with the engineer and conceded that if the last stake was not set, the land would have to be paid for. So a note was written on a page of the notebook, stating that the last stake had not been driven, and given to the owner, who was satisfied.

Two railroads crossed the town of Winthrop, Mo., opposite Atchison, Kans.; the Santa Fe was nearest the river, and the Burlington farthest. Although the town was protected by the David Neale system, a big flood on the Missouri and change of channel took everything between the Burlington tracks and the river. A few years later another flood and channel change put the river bank back, much as before, and the Santa Fe was encouraged to rebuild its track. Then the legal department was asked about right of way. Did the former lot owners regain the lots they had had before the first flood, or did the owner of land outside the Burlington get all by riparian right? The legal department said it would be safest to condemn as against unknown owners.

C. D. Purdon, M. Am. Soc. C.E.
Retired Consulting Engineer,
St. Louis Southwestern Railway

St. Louis, Mo.
October 28, 1937

Artificial Vibration and Bridge Structures

To the Editor: I should like to supplement my short paper on "Artificial Vibrations—a New Method of Dynamic Research," published in the April number of Civil Engineering, and the interesting letter on this subject in relation to bridges by K. L. De Blois, Assoc. M. Am. Soc. C.E., in the July issue. As the final result of eight years of tests with "oscillators," both on railway and highway bridges, the following data may be mentioned.

The experiments with artificial vibration were for the purpose of examining the dynamic properties of bridges and vehicles. Between the vehicles and the bridges exist relations that may be described as couples.

In every case during the passage of the moving load the oscillating masses are of different values. The frequency of these oscillating masses is consequently subjected to alterations depending upon whether the part of the load supported on springs—that is, the boiler of locomotives or the chassis of automobiles—moves with the truck or is intercepted by the springs and remains at rest. In a single-track railway bridge of about 160-ft span, the vibrating mass of the structure is related to the mass of a heavy locomotive boiler in the ratio of about 1:1.

The unified oscillation of the whole mass of double weight of a locomotive situated in the middle of the bridge and the bridge itself results in a reduction of the natural frequency to about 0.7. The condition in which two coupled systems with approximately coinciding natural frequencies overlap leads to the appearance of the so-called "beat." The oscillation in which a complete transfer of energy between vehicle and structure takes place is especially worthy of notice.

The stipulation for a complete transfer of energy envisages the approximate coincidence of the natural frequencies of both bridge and vehicle in their uncoupled condition. As a result of this relation, it is possible to make the following classification, which in its essentials accords with the results given in the report of Y. B. Hunley and of the British Bridge Stress Committee.

1. In railway bridges with large spans and, hence, low vertical natural frequency there can be a close approximation to the vertical natural frequency of a locomotive or a heavy freight car.

2. In bridges with medium spans and, hence, relatively higher or natural frequency, the approximation to the natural frequency of the moving load hardly comes into the question. On the other hand, it is possible that the unbalanced masses of the reciprocating parts of the locomotives have the effect of "exciting" forces. At higher, so-called critical speeds, these "exciting" forces may coincide with the natural oscillation of the bridge and thus lead to considerable vibration with a consequently augmented impact coefficient.

3. In bridges of small spans and, hence, a high natural frequency, neither the relatively slow vertical natural frequency of the moving load nor the shock due to unbalanced moving parts can lead to heavy vibrations for the reason that the period of the passage and the influence of the "exciting" forces, is spread over a very short time.

In highway bridges the relations are somewhat different. "Exciting" forces caused by unbalanced masses do not come into the question. Shocks caused by unevenness in the road surface are almost completely non-periodic. They can, however, lead to considerable shaking of bridge and vehicle and increase the impact coefficient. The tires of highway vehicles are especially favorable for a transfer of energy to the bridge and the setting up of the "beat phenomenon" previously mentioned. In other respects the division of highway structures into three classes of large, medium, and small spans, which was made for railway bridges, applies in the same way.

Rudolf K. Bernhard
Consulting Engineer, Baldwin-Southwark Corporation

Philadelphia, Pa.
October 20, 1937

Method of String-Lining Curves Long in Use

To the Editor: In discussing the practical alignments of curves by the use of a string stretched as a chord between two 31-ft stations, Adolph J. Hartman, in the October issue, has dressed up the old "roadmasters' " rule of string-lining a curve and introduced it into academic circles long denied it—so it seems to me. Not that this old reliable method doesn't deserve such honor; more than thirty years ago the string-lining method was then accepted on the Pennsylvania Railroad as a respected member of the technical family of railroad practices to which I was introduced in my early career.

Its principal advantages lay in the fact that it was (1) an easy, rapid method for checking the alignment of curves, and readily applicable in realigning curves, particularly when such curves were located in deep cuts, on long and high fills, or in and on both; (2) a very present help in curve realignment under conditions of heavy traffic; and (3), by far the most comforting to young engineers, a way out in controlling tapered curves with two or three centers—as, for example, such bad places as the Horeshoe at Kittaning Point (just west of Altoona), the Alligrippa curve up the hill, the Muleshoe on the Hollidaysburg Branch, and others of a similar nature.

In his article Mr. Hartman has shown a simple case; the use of sixteenths of an inch and extended computations, together with a chart, involves more than in the old days of a 2-ft rule with tenths marked thereon and a standard engineer's field book in which all data were recorded. The practice, then, was to take field data, make computations, and set tacks for curve realigning at one sitting, as it were. For a curve such as that shown in Mr. Hartman's Fig. 2, about half an hour would be ample for ordinate adjustment; the notes would appear in the field book as shown in the accompanying Table I.

Table I. Sample of Field Notes

Station	Ordinate	Throw	Corrected Ordinate	
9	0.9	–	–	Easement
10	1.3	−0.2	1.1	
11	1.1	+0.1	1.2	
12	1.3	+0.1	1.4	
13	1.6	0	1.6	1° 45′ ±
14	1.8	+0.1	1.7	
15	1.5	+0.2	1.7	
16	2.0	−0.3	1.8	
17	1.6	+0.3	1.8	
etc.				

Edward D. Kingman, Assoc. M. Am. Soc. C.E.
Department of Applied Mechanics, Wentworth Institute

Boston, Mass.
October 25, 1937

Express Highways of Great Value

To the Editor: I was much interested in the article, "The Express Road and the Highway System," by John S. Crandell, M. Am. Soc. C.E., in the October issue, and particularly in his endorsement of "express" roadways.

Whether the express lanes shall be defined and protected from lateral intrusions by law or, as I have long contended, by a form of construction that will obviate the need of policemen and lawyers, is not the point of this letter. What I now wish to applaud is the following statement by Professor Crandell: "We need express highways—not only close to our large cities, but also up and down and across our land. It is true that in the states west of the Mississippi, excluding California, there is not enough traffic to warrant the expense of such a scheme, but this does not mean that now is not the time to acquire land for the subsequent building of these roads when the need arises. In built-up sections of the country it is going to be costly to obtain a right of way sufficiently wide for a well-defined express highway, but the longer we wait the more expensive it will be. Also, the longer we wait the more expense is being incurred by the motorist."

This statement by Professor Crandell, which has long been an opinion of my own, contrasts refreshingly with the views attributed to Thomas H. MacDonald and stated on page 685 of the same issue. Evidently Mr. MacDonald still clings to that unfortunate "before-the-New-Deal" belief that highway improvement is justified only to the extent of the financial returns from it, and refuses to consider such real returns or benefits as convenience, enjoyment, and safety.

I regret that Professor Crandell's article is marred by an incorrect date (1928) for the beginning of Italy's work. Among the papers submitted to the Fifth International Roads Congress at Milan in 1926 is one (No. 53) by Lafarina and Depertrini on "Special Roads Reserved for Motor Traffic," which states that "The Government concession was obtained 1st Dec., 1923, and the Milan-Laghi motor road is now an accomplished fact. About 36 km long, it connects Milan to Como, to Varese and Sisto Calende."

I traveled over this road in 1926. Others have since been built, as Professor Crandell notes.

W. W. Crosby, M. Am. Soc. C.E.
Consulting Engineer

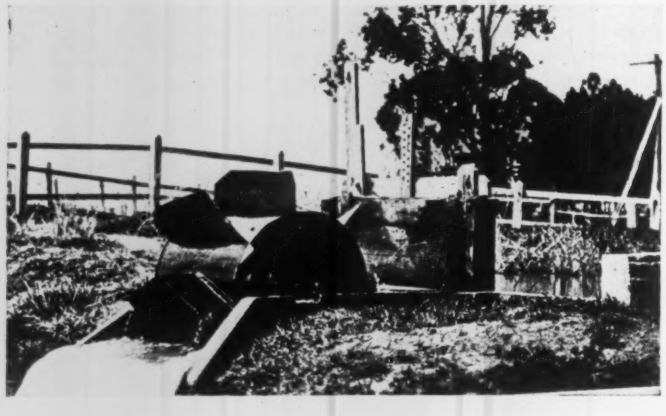
Coronado, Calif.
October 19, 1937

Water Meter in Extensive Use in Australia

TO THE EDITOR: I have read with interest the article, in the July issue, by H. H. Kidder, M. Am. Soc. C.E., on the "Measurement of Irrigation Water." Mr. Kidder refers to a meter introduced from Australia, which was one of the first really successful mechanical measuring devices. He makes no mention, however, of a meter developed later in this country, which has here completely superseded all earlier types. It was devised by the late J. S. Dethridge, M. Inst. C.E., a former commissioner of the State Rivers and Water Supply Commission, whose chairman at the time was the late Elwood Mead, M. Am. Soc. C.E.

This meter was designed primarily to measure and record the quantities of water supplied from open channels for irrigation, and for this purpose the requirements were as follows: (1) capacity to range from 1 to 5 cu ft per sec; (2) loss of head to be reduced to a minimum; (3) parts to be of such strength and simplicity that the meter would work with little or no attention under ordinary field conditions; (4) measurement to be of a positive nature so devised that no flow of value to the consumer could pass through without being recorded; and (5) cost to be low enough to permit of at least one meter being provided for each consumer throughout an irrigation system.

It consists of a rotor revolving in a fixed case. The rotor is a cylinder, open at the ends, to the external surface of which angular vanes are riveted. Both cylinder and vanes are of 14-gage mild steel coated with anti-corrosive preparation. The cylinder is mounted on three crosses of 4 by 2-in. hardwood, which are keyed to an axle of ordinary 1-in. pipe turning on plain hardwood bearings. The case for the rotor is of reinforced concrete about 3 in. thick and may be built in position or molded in sections with the steel projecting and then set up and jointed in place. An encased counter, driven off one end of the axle by means of a loose link, registers the water passed to 0.01 acre-foot.



WATER METER IN USE ON AUSTRALIAN IRRIGATION PROJECT

The principle of the meter is positive measurement. If it were possible to make the edges of the cylinder and the vanes close fitting to the case, the quantity of water passed per revolution would be the same at all rates of flow. But in ordinary field practice it is usual to allow a clearance of $^1/_4$ in. between the rotor and the case. The resulting variation in discharge per revolution, over the range of 1 to 5 cu ft per sec, is approximately 5 per cent. Over the same range of discharge the head loss through the meter varies from $^1/_2$ in. to $3\,^1/_2$ in.

The standard size in general use in Victoria has a capacity of from $^1/_2$ to 5 cu ft per sec, but a smaller size with a maximum capacity of $2\,^1/_2$ cu ft per sec is also used.

The merits of the meter are delivery with small loss of head, accurate and continuous record, and freedom from risk of being tampered with, because effective delivery ceases with stoppage of revolution. It is found that ordinary floating debris causes no trouble, the rotor having power enough to crush it. A gate with locking device in the case provides for shutting off or regulating the flow, the latter being an easy matter with the standard size, as the attendant has simply to allow one revolution per minute for each half cubic foot per second required.

The cost of a standard meter, installed complete, varies from $40 to $60. There are about 12,000 meters in operation in Victoria at the present time, and in some instances the original wheels have lasted up to 20 years without replacement. The counters, however, require more frequent renewal.

Further particulars of this meter are given in *Bulletin No. 215*, published by the Agricultural Experiment Station of the Colorado Agricultural College in 1915.

LEWIS R. EAST, M. Am. Soc. C.E.
Chairman, State Rivers and Water Supply Commission

Melbourne, Australia
October 12, 1937

Urgent Need for Maps in Highway Surveys

TO THE EDITOR: In his article in the July issue J. C. Carpenter, M. Am. Soc. C.E., has clearly demonstrated both the need for, and the lack of, accurate maps showing general topography and natural and artificial boundaries. The average map, so-called, is little more than an elaborate diagram, and falls so far short of furnishing any reliable information that, when attempting to use them, one usually thinks, as did Edrisi, "God only knows how this is."

To illustrate the day-by-day value of such a system of maps as Mr. Carpenter is advocating, I shall give one example of its application to the planning and construction of highways. In 1930, when the large highway construction program was started in Louisiana, I learned that the U. S. Coast and Geodetic Survey would undertake to furnish a complete control survey with a 50-mile spacing at a cost of $112,000, the state of Louisiana to contribute $28,000. It was intended to employ this control survey as a basis for, and in connection with, an aerial survey which in turn, would be used both directly and as a means of preparing any special maps desired. Correspondence with one of the leading aerial survey companies indicated that a satisfactory aerial survey could be made at a cost of approximately $300,000. However, I was unfortunately unable to arouse any interest whatever in the production of such a map and was unable to secure funds for it.

We are now engaged in completing a survey for a highway from Shreveport to the Rodessa oil fields on a new location. It has been necessary to run several preliminary lines prior to the selection of final location. The cost of the preliminary lines was approximately $2,500. Had there been available a reasonably accurate topographic map, it would have been relatively simple to project a desirable location without making these surveys. In addition, there is no assurance that the final location is the optimum location, because the time and money necessary for complete reconnaissance were not available. It is quite possible, therefore, that the cost of construction on the location selected will be greater by many thousand dollars than it might have been. It would not require many repetitions of this cost to finance a complete, controlled survey of the state of Louisiana. In fact, it is probable that the funds necessary to make such a survey have already been expended in the manner described.

It is most unfortunate that those who have the authority to provide funds for such undertakings are not those who use and appreciate the value of maps. The only solution, therefore, is continued and persistent requests to state officials and legislatures to provide the necessary funds. It is very easy to permit interest to relax in matters of this kind. However, Mr. Carpenter's article is so forcible a reminder of the value of maps that another effort will be made to secure funds for the preparation of a map of the state of Louisiana.

HARRY B. HENDERLITE, M. Am. Soc. C.E.
State Highway Engineer, State Highway Commission

Baton Rouge, La.
October 24, 1937

Computing Howe-Truss Brace Length

DEAR SIR: In the September issue of CIVIL ENGINEERING there was an article by Russell Chase, Assoc. M. Am. Soc. C.E., showing a method of figuring the length of a brace for a Howe Truss. I have developed a method of computing this brace that seems to me simpler, in that the angle α is arrived at by approximations of similar triangles.

The method is illustrated in Fig. 1. Since triangles ABC and EOA are similar,

$$\tan\alpha = \frac{h-y}{b-x},\ x = c\sin\alpha, \text{ and } y = c\cos\alpha.$$

Find α by solving $\tan\alpha = \frac{h}{b}$, and then find x and y for this value of α. Then find α for $\tan\alpha_1 = \frac{h-y}{b-x}$, compute the corresponding values of x and y, and continue until a value of α is obtained which is sufficiently close to the true value.

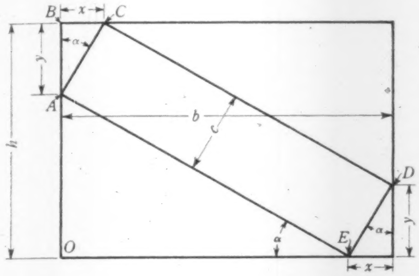


FIG. 1. PANEL OF HOWE TRUSS

As an example, let $h = 9.0$, $b = 16.0$, and $c = 2.0$. The successive values found by using a seven-place table of logarithms were:

α	$h - y_1$	$b - x_1$	y_1	x_1
29-21-28	7.25686	15.01946	1.74314	0.98051
25-47-20	7.1992	15.12989	1.8008	0.87011
25-24-52	7.19402	15.140676	1.80598	0.859324
25-24-41	7.19355	15.141674	1.80645	0.858326
25-24-41	7.19353	15.14177	1.80647	0.85833

From this the length of the diagonal is found to be 16.7637.

GEORGE S. FROST, Assoc. M. Am. Soc. C.E.

Philadelphia, Pa.
October 21, 1937

Caution on the Use of "Bracket Method" in Computations for String-Lining

TO THE EDITOR: The article by Adolph J. Hartman, on "Practical Curve Alinement by Use of String-Line Method," in the October issue, directs attention to a method of lining curves, which is daily becoming of greater importance. With the general increase in passenger train schedules and the introduction of special high-speed trains, curve alinement not only must be of greater precision than heretofore, but the increased impact of these trains will make it necessary to aline curves more frequently.

It is important that the maintenance engineer should have at hand a method by which curves can be rapidly, cheaply, and accurately alined with a minimum engineering personnel. Not only does string-lining offer these various advantages, but it is considerably more accurate than the old method of deflection angles established with a transit. Although the transit method may produce a more nearly perfect geometrical curve, no part of the curve will be as smooth as that lined by string-lining. In addition, the most complicated type of compound or spiral curvature can be handled with simple computations and with a complete elimination of trial and error. The solution requiring minimum throws is easy to find with this method, and when the problem is further complicated by limited clearances, string-lining is the only method practicable.

For those not familiar with string-lining computations it should be clearly pointed out that Mr. Hartman has covered only a certain part of the necessary computations and, in addition, has illustrated only one method of making this part of the computations. The method that he describes, called the "bracket method," is an excellent device for accelerating computations, but alone it will not give a solution. For purposes of exposition of the "bracket method" the illustration used is excellent, but the engineer attempting to compute a curve according to the directions given in the article would soon come to grief. Actually the curve was solved when the "desired ordinates" (Col. 3 of Mr. Hartman's Table I) were chosen. It is only by chance that these ordinates should be picked from the graph so that they could be used without correction.

The "desired ordinates" must be chosen so that the resulting "algebraic differences" (Col. 4) satisfy two equations, as follows:

$$\Sigma e = 0$$
$$\Sigma se = 0$$

where e represents the "algebraic difference"—that is, correction—and s represents the distance of each correction from any given point beyond the application of corrections.

There is an obvious analogy in static forces. If the corrections are assumed to be forces, the moment and shear must be zero beyond the application of corrections.

The necessary equations have been satisfied by Mr. Hartman's choice of "desired ordinates." When these conditions obtain, any bracket, which itself satisfies the equations, may be introduced anywhere. Mr. Hartman's brackets are one form of possible introductions.

To illustrate the point further, using Mr. Hartman's rule for computing the throws it is possible to compute all the throws from the desired ordinates without use of brackets at all. The brackets are an unnecessary step, as shown in the accompanying Table I.

TABLE I. COMPUTING THROWS WITHOUT USE OF BRACKETS

STATION (1)	ORIGINAL ORDINATE (2)	DESIRED ORDINATE (3)	ERROR (4)	ERROR SUMS (5)	HALF THROWS (6)
5	0	1	−1	−1	0
6	6	4	+2	+1	−1
7	5	7	−2	−1	0
8	9	10	−1	−2	−1
9	14	13	+1	−1	−3
10	20	16	+4	+3	−4
11	17	19	−2	+1	−1
12	21	22	−1	0	0
13	25	25	0	0	0
14	28	27	+1	+1	0
15	24	27	−3	−2	+1
16	32	27	+5	+3	−1
17	25	27	−2	+1	+2
18	30	27	+3	+4	+3
19	25	27	−2	+2	+7
20	23	27	−4	−2	+9
21	23	27	−4	−6	+7
22	23	26	−3	−9	+1
23	28	23	+5	−4	−8
24	28	20	+8	+4	−12
25	17	17	0	+4	−8
26	13	14	−1	+3	−4
27	8	11	−3	0	−1
28	7	8	−1	−1	−1
29	6	5	+1	0	−2
30	3	2	+1	+1	−2
31	0	0	0	+1	−1
32	−1	0	−1	0	0
33	0	0	0	0	0

The values in Col. 4 of my Table I are obtained by subtracting the values in Col. 3 from those in Col. 2. The result gives the error in the original ordinates. The values are the same as those found in Col. 4 of Mr. Hartman's Table I, but with the opposite sign. The values in Col. 5 of my Table I are the results of the cumulative addition of the values in Col. 4. The values in Col. 6 are the results of the cumulative addition of the values in Col. 5 entered one station below their normal position. (Note: double the half throws to obtain the throws.)

Returning to the analogy, it will be noted that the half throws represent the moment at each station caused by the preceding errors, and the error sums represent the shears.

PHILIP KISSAM, Assoc. M. Am. Soc. C.E.
Associate Professor of Civil Engineering
Princeton University

Princeton, N.J.
Oct. 26, 1937

Economic Value of Express Highways

TO THE EDITOR: In his article on "The Express Road and the Highway System," in the October issue, John S. Crandell, M. Am. Soc. C.E., indicates that the traveling time between downtown New York and Newark has been reduced from 2 hours and 7 minutes to 20 minutes by the construction of the Holland Tunnel and the New Jersey express highway between Jersey City and Newark. This is a specific example of the economic value of express highways. The combined cost of the tunnel and the highway was about $120,000,000, and the annual traffic amounts to approximately 10,000,000 vehicles. On the basis of the traveling time quoted, the total time saved amounts to 1,070,000,000 vehicle minutes per year. This means that the money value of the time saved each year is more than twice the annual interest on the cost of the construction of the tunnel and the express highway. In addition, there has been a material saving in cost of vehicle operation between the two cities, and the new route provides additional traffic lanes necessary for adequate traffic facilities.

Important as these advantages are, however, they may be considered incidental to the underlying purpose of express highways. We do not build highways just for the convenience of vehicles. We build them to give the vehicles that use them the opportunity to perform swiftly and economically a necessary part in the development of our resources, general wealth, and well being. If we fail to build the proper roads, we stand in the way of our own future development.

Before the Holland Tunnel and the New Jersey express highway were built, it was apparent that there was a potential traffic undeveloped on account of insufficient facilities. With the completion of these structures there has been an enormous increase of traffic, and that increase means a corresponding increase in our development.

The construction of railroads in the United States, during the latter half of the nineteenth century, was the primary cause of the undreamed of development of the country. Express highways, properly located and designed, will probably have an influence on the development of the country comparable to that caused by the railroads in the last century.

Professor Crandell states that the European express highways are essentially military roads. I do not think that this is important, except in so far as it may mean that the money necessary for their construction will be more readily produced. As a matter of fact, the presence of the express highways cannot fail to provide an impetus to the further development of the peace-time resources of the countries through which they pass.

In financing express highways, it must be remembered that in the United States a boundary line of a state rarely marks the limit of communication. The boundary lines of the state of New Jersey are crossed each year by nearly 40,000,000 foreign vehicles, and more than 40 per cent of the traffic on some of its most important highways originates in other states. For that reason, the principal express highways should generally be planned and located as interstate routes, and it is reasonable to assume that they be financed by the federal government. In addition to these principal express routes, intrastate express highways may be needed. The latter would properly form a direct part of the state highway systems and should be financed as such; or if the conditions warranted it, they might be built by private capital and operated as toll roads for a limited number of years.

Professor Crandell calls attention to the need for express highways into and through large cities. Heretofore highways have been located so as to by-pass smaller as well as larger communities. Although this practice is entirely sound, in large cities the travel over congested streets may be difficult and slow for those who wish to enter the heart of the city from the highways, as well as for those who want to go from one part of the city to another. However, I do not think that for this reason we should reverse our policy and carry the express highway through the city. Instead we should build one or more spurs through the city and connect them with the principal highway. These spurs may be carried on viaducts constructed in the middle of certain suitable streets.

SIGVALD JOHANNESSON M. Am. Soc. C.E.
Designing Engineer, New Jersey State Highway Department

Trenton, N.J.
November 3, 1937

The Trailer and Problems of Sanitation

TO THE EDITOR: The article on "Tourist Camp and Roadside Sanitation" by Edward D. Rich, M. Am. Soc. C.E., in the October issue, stresses one of the important modern trends in public health activities—namely, that of public health education. The average American resents legal pressure to force him to do certain things which, on account of his lack of understanding of the reasons or necessity therefore, he may consider non-essential. On the other hand, he is usually alert to notice improvements in environment, especially when such improvements afford increased comfort and safety for his family, and eliminate some of the health hazards that beset mankind. It has been the practice in the Detroit Health Department to employ court procedure for the enforcement of sanitary measures only after all other methods have failed to accomplish the desired results. Were it not for the educational methods employed, our ordinance court would doubtless be swamped with cases.

Improvement in the sanitary condition of swimming pools in the Detroit area may be cited as an example of results obtained by methods suggested by Mr. Rich. Without the issuance of a single official order or resort to high-pressure methods, the standard of purity for pool waters has been gradually raised to one more stringent than the U. S. Treasury Department standard for drinking water. Furthermore, 90 per cent of the pools are able to consistently maintain even this high standard of purity.

The practical value of education by comparative conditions may, as Mr. Rich states, be difficult to evaluate. Nevertheless, it seems logical to assume that the tourist will recognize and appreciate the sanitary facilities afforded by an up-to-date roadside camp or comfort station, and will shun those not properly equipped and maintained.

It seems to be the price of progress that, before sanitary perfection in the correction of any given condition is attained some new problem arises. The trailer is a glowing example of this fact. It must be conceded that the trailer is here to stay and is destined to play an important rôle in our social, sanitary, economic, and perhaps political structure. Apparently it has not been necessary to modify the existing practice of waste disposal as employed on railroad coaches. It is, however, not pleasant to anticipate any attempt to apply a similar system to the house trailer. It is now obvious that better methods must be evolved for providing sanitary conveniences in trailers and for trailer occupants in camps, if the general use of this type of dwelling is not eventually to be discouraged by lack of such conveniences.

It is reasonable to assume that local communities will be able to control the trailer parking and occupancy problem by sane and practical regulations. Some municipalities have enacted ordinances to promote sanitation and, at the same time, safeguard local social and economic standards. With the present rapid increase in trailer sales, it should not be long before the success or failure of sanitation measures connected with their use is demonstrated. Perhaps, in the near future, mobile home units of considerable size will be common along our highways, or even in our cities and villages. Some manufacturers are now producing, or intend to produce, sizable mobile home units, which they offer as a possible solution of the housing shortage that is quite acute in certain parts of the country. Just how far this method of housing will progress and what influence it will have in modifying our existing building and housing regulations is a matter of conjecture. At present the trailer is most in demand by vacationists who desire to combine touring with occasional stops along the route for either recreational or sight-seeing purposes. It is doubtful, though, if the majority of the people will abandon the idea of permanent homes for homes on wheels.

New inventions create new demands. In satisfying these demands, the sanitary engineer must keep abreast of the progressive developments of transportation that make possible the continual movement of large masses of people along our highways, and through our public parks and urban communities.

F. GARDNER LEGG, JR., Assoc. M. Am. Soc. C.E.
Sanitary Engineer, Detroit Department of Health

Detroit, Mich.
Nov. 1, 1937

SOCIETY AFFAIRS

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Annual Meeting Now in Preparation

Interesting Events Scheduled for January 19–22, 1938

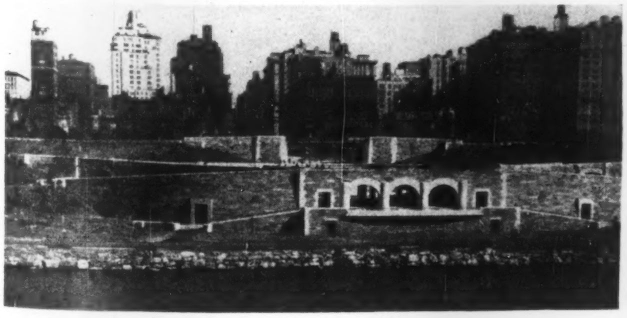
For a number of months, preparations have been quietly under way for the Society's next Annual Meeting. The official program, which appears regularly without fanfare, may give an impression of simplicity and automatic growth. But nothing could be farther from the truth. It is true that the time for the meeting, fixed by the Constitution, is known far in advance; but all the arrangements must be carefully planned each year. The committee on arrangements for the 1938 meeting was appointed months ago; certain essential reservations for accommodations were of necessity made early in the year 1937; and the various subdivisions of the meeting were studied and organized to secure the best possible arrangements. For these reasons, it is feasible at this early date to give a general forecast of the meeting.

Honors and Prizes Bestowed

On the third Wednesday of the month, January 19, 1938, the Annual Meeting will convene in the Engineering Societies Building at 10:00 o'clock. After the usual opening formalities will come an event of special significance—the bestowal of Honorary Memberships. This year, four notable engineers have been selected for this honor: George S. Davison, Otis E. Hovey, Joseph R. Worcester, and (posthumously) Hunter McDonald. Engineers will take pleasure in acclaiming such capable and eminent men, who for many years have reflected great credit on the profession.

At this meeting also accomplishments of a high technical order will be officially recognized in the award of Society prizes. A splendid list, scheduled for the 1938 meeting, includes the award of the Norman Medal to J. C. Stevens, M. Am. Soc. C.E.; the J. James R. Croes Medal to Inge M. Lyse, M. Am. Soc. C.E., and Bruce C. Johnston, Jun. Am. Soc. C.E.; the Thomas Fitch Rowland Prize to Eugene A. Hardin, M. Am. Soc. C.E.; the James Laurie Prize to Boris A. Bakhmeteff, M. Am. Soc. C.E., and Arthur E. Matzke, Jun. Am. Soc. C.E.; the Arthur M. Wellington Prize to E. C. Harwood, Captain, Corps of Engineers, U. S. Army; and the Collingwood Prize for Juniors to Victor L. Streeter, Jun. Am. Soc. C.E. The Rudolph Hering Medal is also to be awarded through collaboration with the Sanitary Engineering Division of the Society. It will go to W. W. Horner, M. Am. Soc. C.E., and F. L. Flynt, Assoc. M. Am. Soc. C.E.

An important part of the Wednesday morning program will be the business meeting, at which an amendment, or amendments, on the Society's Constitution will be reported upon and discussed. Following comes the report of the tellers, announcing election of Society officers. The President-elect and the new Vice-Presidents and Directors will then be introduced to the assemblage and inducted into office with the usual addresses of recognition and acceptance.



Traffic Structure at 79th Street and the Hudson River
Scene Along the New West Side Improvement to Be Visited on Proposed Inspection Trip

Luncheon has been arranged within the Engineering Building for the convenience of those who can remain for the afternoon. Following this sociable intermission, the entire meeting will gather for a general afternoon session. Details of this part of the program are still in process of development but will be announced shortly. Wednesday evening has been set aside for the formal social event of the meeting, the Dinner Dance and Reception. Reservations already made at the Waldorf-Astoria Hotel will guarantee a beautiful setting and ample space for this occasion.

Eight Technical Sessions in All

On Thursday both morning and afternoon will be devoted to sessions of the Technical Divisions. Simultaneous meetings will be going on all day in various rooms at the Engineering Societies Building. The City Planning Division has reserved a half day for its meeting. On its schedule are such subjects as the design of parkways and boulevards, zoning failures and remedies, and housing. These should prove attractive to a large number of engineers.

Another group, the Highway Division, has also been allotted a single session. Its program has considerable interest, both locally and generally. Under present plans, it will discuss (1) provisions for vehicular traffic at the New York World's Fair in 1929; (2) traffic problems in metropolitan areas; and (3) highway development in Mexico.

Because of the importance and extent of its program, the Power Division has reserved an entire day. Emphasis will be placed on the general subject of cost of power. To cover this properly a symposium of papers has been arranged, all bearing on the main theme under the following subdivisions: (1) Elements of power cost, (2) cost of heat-generated energy, (3) cost of hydro-generated energy, (4) cost of combined energy generation, (5) cost of depreciation and obsolescence in power generation, and (6) closing paper. These papers on live topics should attract wide attention and appeal to students of power and economics.

The Sanitary Engineering Division will also require both a morning and an afternoon session to accommodate its large program. In the forenoon, it will receive and discuss reports of Division committees. In the afternoon, two symposiums are on the schedule, (1) air sanitation, and (2) industrial hygiene engineering. A feature of these meetings will be the presence of members of the New York State Sewage Works Association, which will hold its annual meeting in New York at the same time. Also, in the evening the two bodies will join forces in a special dinner. Prof. Henry E. Riggs is scheduled as the speaker.

Another Division to plan an ambitious program is the Structural Division, which will also hold two sessions, morning and afternoon. In the morning, a report on fatigue tests of riveted joints will be presented and discussed; likewise, the subject of related functions of cable and stiffening trusses in suspension bridges. The general topic in the afternoon will be engineering architecture. This session will be introduced by a formal paper, after which it is planned to have a round-table discussion of constructive character.

Social Events Also Planned

These splendid programs will tax the time and attention of members and guests throughout the day. Relaxation is therefore in preparation for the evening. In addition to that provided by the dinner for sanitary engineers, early dinners have been arranged by a number of college alumni. These are all scheduled to end in time for a general gathering, the smoker, usually the most popular event of the entire meeting. The time has been set for 8:00 o'clock and the place will be the Grand Ballroom of the Waldorf-Astoria Hotel—a fortunate selection since this gathering is of such size and appeal as to tax the capacity of the largest hall available. As usual, entertainment will be offered, but the great attraction of the smoker is the opportunity it affords to meet old friends and make new ones. Light refreshments will be served in the course of the evening.

On Friday there will be another full day of events. Sanitary engineers of the Society, returning the courtesy of the New York State Sewage Works Association, will join the Association in its all-day meeting at one of the large hotels. Others will doubtless enjoy an all-day inspection trip. Plans are now maturing to secure permission to view a number of outstanding engineering projects within reach of Manhattan. A fine lunch is always an essential feature of such an all-day trip. The ladies, who are invited to enjoy this occasion, have come to consider it one of especial interest. As regards social events, some college reunions are also scheduled for Friday evening.

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In addition, Saturday will be utilized for inspection trips. The joint group of sanitary engineers have a number of prospects in mind. Then there are recent local developments which should prove most interesting to varied groups. Among these are several sections of subway work, important vehicular tunnels, the fast-growing World's Fair site, and the newly completed West Side improvements along the Hudson River.

Ample plans have been made for the entertainment of the ladies while the men are busy with technical meetings. Teas, parties, and inspection trips are in preparation.

BERMUDA TRIP, AS USUAL

One special event, although not strictly a part of the meeting, should be emphasized. For several years, it has been the practice to plan a special party to Bermuda immediately following the Annual Meeting. Arrangements are being made this year to leave on Saturday, January 22, and return on the following Saturday, January 29. This event has come to fill an important place in the plans of many who attend the Society's Annual Meeting.

This general announcement is intended merely to present a bird's-eye view of the coming 1938 Annual Meeting. Full details will be given in the official program, to appear in the January number.

David Cushman Coyle for President; Nominee by Declaration

THE WRITER would like to nominate Mr. David Cushman Coyle for President of A.S.C.E. for 1938, and would suggest to all members of our Society, who think likewise, to vote for him, when they return their ballots before the Annual Meeting in January.

Our Society would be honored, if David Cushman Coyle became its President. There is hardly any other engineer in the country who has had more influence on straight economic thinking than Mr. Coyle has had since the start of the late depression. His name has become synonymous with the new understanding of what constitutes "sound" economics, through such pamphlets as *Business Versus Finance, Brass Tacks, Uncommon Sense, Age Without Fear, Waste, Why Pay Taxes, Balance What Budget*, etc.

As a consulting engineer in New York City, where he still maintains his office, Mr. Coyle for several years worked on the design of some of Manhattan's skyscrapers, those monuments to the "sound" economics of the twenties, as Mr. Coyle calls them! After 1933 Mr. Coyle has spent most of his time in Washington, as a member of the Board of Review of the PWA and in other capacities as adviser to the present administration on engineering economics.

Like so many other engineers during the depression, Mr. Coyle woke up to the realization that millions of men working in public service cannot in any possible way make the nation poorer because of the debt, than if they don't work.

Due to this philosophy, civil engineers all over the country, and in a greater number possibly than any other engineering group, have found work in the last four years.

In the next year, probably a year of contraction of public works, it is highly important that our Society have as its head a President who understands the social and economic forces of our time, a man who is not prejudiced by old conceptions of "sound" economics, a man who has gained the confidence among the lawmakers, and who is listened to, when he speaks on engineering-economics of public works. Our Society will have a great duty to perform in advising our lawmakers where tangible returns are not commensurate with the investments. But if this advice is colored by the particular engineer's political predilections, we shall be getting nowhere; and, particularly, if this advice shows a lack of understanding of the intangible benefits existent in many useful projects, we shall not be able to be listened to by the Congress.

By electing David Cushman Coyle as our President for 1938, we shall avoid these dangers. By electing Mr. Coyle, we shall be able to disprove to the country that civil engineers don't understand much beyond the limits of their drafting table. By electing Mr. Coyle, we shall have an opportunity to show our disagreement with that narrow understanding of engineering economics as contained in the progress report on "Government Expenditures for Public Works," viz.:

> "A Federal Works program should be based upon sound economic considerations *exclusively*."(!) (See PROCEEDINGS for February 1936).

I appeal to all engineers of our Society: Let us elect as President for 1938 a nationally known engineer, whose hands are not tied, who is free to tell the facts, and who has shown that he has a broad understanding of the economic implications of public works

Let us honor the Society and elect:

David Cushman Coyle for President.

ROLF T. RETZ
Knoxville, Tenn.

November 5, 1937

The following Corporate Members signed the original nomination of Mr. Coyle by "Declaration":

Rolf T. Retz
John F. Partridge
C. E. Blee
O. Laurgaard
N. W. Dougherty
Howard W. Goodhue
Harry Wiersema
A. S. Fry
George E. Tomlinson
P. J. Freeman
C. E. Pearce
J. H. Wilkinson
James E. Goddard
R. G. Perkins
R. D. Field
Kenneth W. Ross
Paul C. Klyce
B. B. Brier
Charles E. Nichols
R. T. Brown
G. H. Hickox
John F. Pierce
Franklin Pitcher
G. Slover
Robert T. Colburn

A total of 62 had signed the nomination before the twenty-fifth day of November, the final date as defined by the Constitution.

Mr. Coyle has accepted the "Nomination by Declaration."

Henry Earle Riggs for President; Official Nominee

THE Nominating Committee for President of this Society is created by the Constitution. It consists of the 19 Directors and the two last living Past-Presidents. These men, elected by the membership, represent the 16 Districts into which the Society is divided. This wide representation in the Nominating Committee was adopted after years of experience to insure that there would be a nominee that so far as possible would be widely representative, free from the influence of local factions, and best fitted for this important office.

In presenting the name of Henry Earle Riggs as the official nominee for President of the Society for the year 1938, the Nominating Committee records the reasons for his selection. In its opinion, the office of President requires a man:

(*a*) Possessing the highest integrity and fairness.
(*b*) Eminent in the profession of engineering.

(c) Commanding the respect of all men who know him.
(d) Well and favorably known throughout the country.
(e) Experienced in the affairs of the Society.
(f) Willing and able to devote a year of hard work to Society affairs.

Henry Earle Riggs possesses all these qualifications to a high degree. His accomplishments and abilities are personally known to each member of the Nominating Committee. A brief biography is printed elsewhere in this issue of CIVIL ENGINEERING.

In his life work the theoretical and the practical elements of his experience have combined to make him a man of technical ability and good judgment. Inheritance from pioneer ancestors has endowed him with the best of common sense. His work has included 9 years in railroad service, during which he rose to the office of Chief Engineer, followed by 16 years in the general practice of engineering, in which he was engaged in the design and construction of steam and electric railways, and of important public works including harbor improvements, water, and sewage works. This was followed by 18 years as a teacher of engineering at the University of Michigan, during which his personality has been impressed upon many hundreds of civil engineers who have passed through his classes and who hold him in the highest regard as a teacher, an engineer, and a man. He is now retired with the title of Honorary Professor of Civil Engineering, and is at liberty to follow his own pursuits.

For more than three decades, his advice has been sought in important matters by municipalities and public utility commissions, as well as by railroads and power enterprises, largely on questions relating to valuation, rates, and other undertakings. In these engagements his engineering and business ability, his fairness, his straight thinking, and his clearness in the expression of his conclusions, were important considerations.

Dr. Riggs has been a member of the Society for 44 years. He has successively filled the offices of Director and Vice-President, and while he held these offices he was especially active in the affairs of the Society and discharged his duties with exceptional ability. During each of his two years as Vice-President, he was called upon to devote much of his time and energy to several investigations that required perception, tact, and good judgment, in which assignments he was successful in the highest degree.

Probably no member of the Society is more widely known or more highly respected by engineers. He is noted for his willingness to listen, his deference to the opinions of others, his tenacity in developing the truth, and his self-reliance when he has examined all sides of a question.

These are the reasons that have influenced the Nominating Committee in the selection of Henry Earle Riggs as the "Official Nominee" for President.

Respectfully submitted,
CHAS. B. BURDICK
Chairman Nominating Committee

The following are the members of the Society's Nominating Committee which selected Dr. Riggs, unanimously, as "Official Nominee" for President:

E. P. Arneson
Chas. B. Burdick
Ivan C. Crawford
R. P. Davis
A. W. Dean
James L. Ferebee
James K. Finch
L. L. Hidinger
Raymond A. Hill
T. Keith Legaré
Theodore A. Leisen
Daniel W. Mead
H. S. Morse
C. E. Myers
E. R. Needles
*C. Arthur Poole**
Carlton S. Proctor
William J. Shea
Herman Stabler
Thomas E. Stanton, Jr.
Arthur S. Tuttle

** Since deceased*

Professional Records of Nominees

Brief Biographical Sketches of Candidates for Society Offices

HENRY EARLE RIGGS

HENRY EARLE RIGGS
Official Nominee for President

HENRY EARLE RIGGS was born at Lawrence, Kans., on May 8, 1865. He graduated from the University of Kansas in 1886, receiving the A.B. degree, and in 1910 he received the degree of C.E. from the University of Michigan. He was on railway construction and maintenance in Nebraska, Missouri, and Texas from 1887 to 1890, and was chief engineer of a 300-mile railroad in Michigan from 1890 to 1896. He was a member of the firm of Riggs and Sherman, consulting engineers, of Toledo, Ohio, from 1896 to 1912, engaged in the design and construction of steam and electric railways, harbor improvements, water works, and sewage works. From May 1, 1912, to June 30, 1930, he was professor of civil engineering, and head of the department of civil engineering at the University of Michigan. On the latter date he retired from active administrative work with the title of honorary professor of civil engineering.

Since 1908 his personal work has been largely in valuation and in the preparation of cases dealing with theories of valuation and depreciation. Professor Riggs has been retained by many carriers on cases involving the federal valuation of railroads and recapture of excess profits—among them the New York Central, the Illinois Central, the Norfolk and Western, the Chesapeake and Ohio, the Virginian, the St. Louis–San Francisco, the Pere Marquette, and the Bangor and Aroostook. He has been retained on public utility rate cases by the state commissions of Michigan, Georgia, and New York, and has made valuations for and represented in litigation the Georgia Power Company, the Alabama Power Company, the Carolina Power and Light Company, and other power corporations. He was appointed by the U. S. Circuit Court to make valuations and report on the Kansas City street railways.

He has acted as consulting engineer for the cities of Detroit, Battle Creek, and Pontiac, Mich., on railroad grade-separation projects, and as a member of the board of consulting engineers of the Belle Isle Bridge, across the Detroit River.

Professor Riggs is the author of a paper on "Valuation of Public Service Properties," in Vol. 72 of TRANSACTIONS (1911); of a volume on depreciation, published in 1922; and of a number of papers on valuation, depreciation, and allied subjects in *Public Utilities Fortnightly, Railway Age,* and *Electrical World.* He served from 1914 to 1917 as a member of the Society's Special Committee on Theories and Methods of Valuation and was one of the joint authors of the report of that committee, which was published in Vol. 81 of TRANSACTIONS.

He is a former president of the Michigan Engineering Society, and a member of the Engineering Institute of Canada, the American Railway Engineering Association, the Society for the Promotion of Engineering Education, the American Transit Association, and the Engineering Society of Detroit. In 1937 the University of Michigan gave him the honorary degree of doctor of engineering.

Professor Riggs became an Associate Member of the Society in 1893, and a Member in 1896. He was Director of the Society from 1932 to 1934, and Vice-President from 1935 to 1936. He has also served as president of the Detroit Section of the Society.

DAVID CUSHMAN COYLE

DAVID CUSHMAN COYLE, consulting engineer, born in North Adams, Mass., May 24, 1887; A.B., Princeton University, 1908; C.E., Rensselaer Polytechnic Institute, 1910. Began with Gunvald Aus Company, consulting engineers, New York City, 1910; with Phoenix Bridge Company, 1911–1912; Lehigh Valley Coal Company, 1912–1917; Delaware, Lackawanna and Western Coal Company, 1917–1918; again with Gunvald Aus Company, 1919–1930; structural designer, New York Life Building, Washington

DAVID CUSHMAN COYLE
Nominee for President by Declaration

State Capitol, Roerich Museum (New York), U. S. Chamber of Commerce Building, Bank of Buffalo, etc. Practicing in own name since 1930. Member of Technical Board of Review, National Public Works Administration 1933–1935; consultant to National Resources Committee. Fellow, American Association for the Advancement of Science; Member American Society of Civil Engineers, American Institute of Consulting Engineers, Architectural League of New York; served on commission on Miami hurricane of American Society of Civil Engineers and commission on hurricane exposure of American Concrete Institute. Congregationalist. Club: Cosmos (Washington). Home, Washington, D.C.; Office, 101 Park Avenue, New York City.

Author: *The Irrepressible Conflict—Business vs. Finance*, 1933; *Brass Tacks*, 1935; *Uncommon Sense*, 1936; *Waste*, 1936; *Age Without Fear*, 1937; *Why Pay Taxes*, 1937; published by National Home Library Foundation, Washington, D.C.

Contributor to numerous magazines, such as *Scribners*, *Harpers*, *Mechanical Engineering*, *Annals of the American Academy of Political and Social Science*, etc. His latest article is in *Harpers* for October 1937 on: "Balance What Budget."

MALCOLM PIRNIE

MALCOLM PIRNIE was born in New York City, but was soon taken to Springfield, Mass., where he prepared for college in the public schools. He received the degrees of Bachelor of Science from Harvard College in 1910, and of Master in Civil Engineering from the Graduate School of Applied Science of Harvard University in 1911.

From that time until 1916, Mr. Pirnie was assistant engineer with the firm of Hazen and Whipple in New York. He then became a partner in the firm, the name of which was later changed to Hazen, Everett and Pirnie. Since June 1929, he has been in private practice in New York.

He is a Member of the American Society of Civil Engineers, of which he was Director from 1928 to 1930 and member of the Committee on Publications at the time that CIVIL ENGINEERING was started. In 1932 he served as president of the Metropolitan Section. He is now a member of the Society's committees on the Rudolph Hering Medal Award and the Freeman Fund. As a member of the American Water Works Association, he has served as director and president and is chairman of its Water Works Practice Committee. In addition, he is a member of the American Institute of Consulting Engineers, New England Water Works Association, Florida Engineering Society, Society of Military Engineers, American Geophysical Union (Section of Hydrology), and a fellow of the American Public Health Association. He is advisor of the General Assembly of the Construction League of the United States, is registered with the National Council of State Boards of Engineering Examiners, and is an official arbitrator of the American Arbitration Association.

MALCOLM PIRNIE
Nominee for Vice-President, Zone I

Mr. Pirnie's professional experience has been distributed over twenty states, parts of Canada, Russia, and France, dealing with problems in sanitary engineering—principally the planning of water works, supervision of operation, and the examination, report upon, and valuation of water-works properties. In 1917 he was sent to Russia as assistant sanitary engineer with the American Red Cross Commission, and in 1918 and 1919 served in France, with the rank of captain, as assistant engineer of water supply under the Director General of Transportation.

During the depression Mr. Pirnie served as chairman of the Plans Committee and of the Construction Legislation Committee of the Professional Engineers' Committee on Unemployment; as chairman of the Public Works Committee of the American Society of Civil Engineers; as deputy administrator of the NRA in charge of codes for the construction industry; and as member of the Engineering Technical Board of Review for the PWA.

For the federal government, he has served as consulting engineer to the Corps of Engineers, U. S. Army, on the ground-water resources of Florida, and as water consultant to the National Resources Board. He has contributed articles and papers on a variety of subjects to the official publications of various engineering societies and to many technical publications.

Since his marriage he has lived in Scarsdale, N.Y., where he has served as village trustee and mayor and is now chairman of the Board of Appeals, which acts on non-conforming use in administration of the zoning ordinance. He is a member of the executive committee of the Board of Governors of the White Plains Hospital and a trustee of Vassar College.

EDWARD N. NOYES

EDWARD N. NOYES was born in Chase County, Kansas, on September 15, 1880, and educated at the University of Kansas. He graduated in 1907 with the degree of B.S. in civil engineering, and in 1925 he received the C.E. degree from the same university. From 1907 to 1912 he was in the employ of Hedrick and Cochran, bridge engineers. During this period he was employed on the construction of the deep pneumatic foundations of the Frisco Bridge over the Atchafalaya River, and also on the construction of the Dallas–Oak Cliff Viaduct, at Dallas, Tex.

In 1912 Mr. Noyes became a member of the firm, Myers and Noyes (now Myers, Noyes, and Forrest), consulting civil engineers of Dallas, Tex. His firm has been employed on a variety of irrigation, reclamation, and municipal engineering projects in Texas, and since 1920 it has served in a consulting capacity on the Dallas Reclamation Project.

During the war Mr. Noyes served in several capacities—in 1917 he was engineer in charge of the construction of the Camp Travis cantonment at San Antonio, and from 1918 to 1919 he was assistant to the plant manager at the Hog Island Ship Yard while that project was under construction.

E. N. NOYES
Nominee for Vice-President, Zone IV

Mr. Noyes is an engineer adviser on the International Boundary Commission between the United States and Mexico, and is a director of the Love Field Development Company. From 1920 to 1924 he was a member of the committee of engineers advisory to the governor of Texas. He is a member of Sigma Xi and Tau Beta Pi and has served on the Board of Education of Dallas, Tex. His club affiliations include membership in the Technical Club of Dallas, the Athletic Club, and the Dallas Chamber of Commerce.

In 1912 Mr. Noyes joined the Society with the grade of Associate Member, and in 1917 he became a Member. He has served on the Executive Committee of the City Planning Division of the Society and on the Society's Committee on Juniors, and for a number of years prior to 1928 he was secretary and treasurer of the Texas Section. He served as Director of the Society from 1933 to 1935.

Arthur W. Harrington

Arthur W. Harrington was born in Watertown, N.Y., on June 7, 1888. Entering Cornell University with a state scholarship, he was graduated in 1909 with the degree of C.E. After several months as leveler in the city engineer's office in Watertown, N.Y., he entered the employ of L. B. Cleveland, engineer and contractor of Watertown, remaining through 1913. In this engagement he gained early experience in general engineering work. In 1912–1913 Mr. Harrington was assistant superintendent and superintendent of construction on extensive station-improvement work and bridge construction for the New York Central Railroad at Potsdam, N.Y.

On January 1, 1914, he was appointed junior engineer in the U. S. Geological Survey and assigned to stream-gaging work in Idaho. This engagement included special investigations on Salmon Falls Creek, Nev., and at Arrowrock, Idaho, as well as routine stream-gaging and construction work in Idaho and adjacent states. Resigning from the Survey early in 1917, Mr. Harrington came east to engage in commercial work, becoming secretary, vice-president, and president of B. B. Culture Laboratory, Inc., Yonkers, N.Y. This connection continued until the summer of 1918 when Mr. Harrington was commissioned first lieutenant in the Sanitary Corps of the U. S. Army.

Arthur W. Harrington
Nominee for Director, District 3

While he was in the army his duties were largely technical and were concerned with the sanitary facilities, water supply, and sewage disposal at a large number of camps and army posts throughout the south. One feature of this work was his design of a drainage system for Ellington Field, Tex. He was discharged from the army in June 1920.

In November 1920 he reentered the government service as hydraulic engineer with the U. S. Geological Survey, being appointed office engineer in the district office at Albany, N.Y. In August 1922 he was appointed district engineer in full charge of steam-gaging work and hydraulic investigations of the Geological Survey in the state, which position he holds at present.

Concurrent with his duties in Albany, Mr. Harrington has had a number of important assignments in other parts of the country. In 1928 he was consultant on surface-water investigations to be undertaken in the lower Mississippi River Basin in cooperation with the Corps of Engineers, U. S. Army. In 1926 he was a member of a committee appointed by the Secretary of the Interior to report on the allocation of power profits in the Minidoka Project in Idaho. In 1934 he was a member of one of the President's technical subcommittees on water flow appointed to advise on comprehensive plans for the development of the rivers and streams of the United States, and in the same year he served as member of the Water Resources Committee of the New York State Planning Board.

Mr. Harrington was elected a Junior in the Society in 1910, Associate Member in 1913, and Member in 1925. He is a registered professional engineer and land surveyor in New York, and a member of the Albany Society of Engineers, the New York State Society of Professional Engineers, the Cornell Society of Engineers, the Engineering Institute of Canada, the American Veterans' Association, the University Club of Albany, and the Federal Business Association of Albany. In 1933 he served as president of the latter organization.

James A. Anderson

James A. Anderson was born at Linden, Va., on December 26, 1892. He was educated in the public schools of Warren County and the Virginia Military Institute. Following graduation in 1913, he taught for one year at Winchester, Va., and for two years at the Virginia Military Institute. He attended Cornell University in 1916 and 1917, receiving the C.E. degree.

In July 1917 he was called to service with the National Guard of Virginia. He served until July 1919, having assignments with Headquarters 30th Division, Headquarters First Army, and 7th Army Corps, Army of Occupation. He was discharged as lieutenant-colonel.

James A. Anderson
Nominee for Director, District 5

In 1919 Mr. Anderson returned to the civil engineering department at the Virginia Military Institute, where he has been in charge of civil engineering since 1920. For three summers he served with the U. S. Bureau of Public Roads, and for two summers was in railroad work. He has had other summer and part-time work in various fields. For three years (1933–1936) he was on leave from his work at Virginia Military Institute, serving as state engineer and state director of the Public Works Administration for Virginia. In November 1937 he was promoted to the position of Dean of the Faculty at Virginia Military Institute.

He became an Associate Member of the Society in 1920 and a Member in 1925. In 1923 he served as president of the Virginia Section of the Society. Mr. Anderson is also a member of the American Railway Engineering Association and of the Society for the Promotion of Engineering Education. He is a registered civil engineer in Virginia.

Louis E. Ayres

Louis E. Ayres was born at Port Austin, Mich., on March 13, 1886, and was graduated from the University of Michigan in 1908 with the degree of bachelor of science in civil engineering. When a senior, he was elected to the honorary fraternity of Sigma Xi.

From 1908 to 1916 and, again, from 1917 to 1923 Mr. Ayres was, successively, a draftsman, designer, principal assistant, and associate with the late Gardner S. Williams, M. Am. Soc. C.E., in his consulting practice in hydraulic and sanitary engineering. From 1912 to 1914 he was an assistant to consultants in the Chicago Sanitary District litigation, and from 1915 to 1916 was in charge of an appraisal of the electrical department of the Chicago Sanitary District and the installation of a new system of accounts.

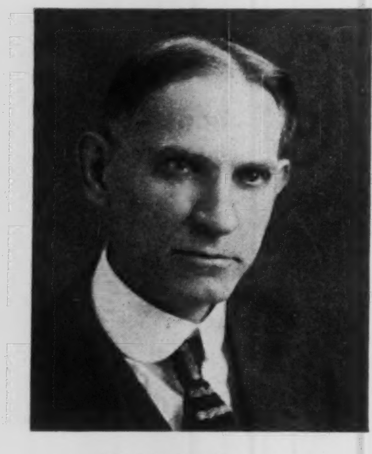
From 1923 to date Mr. Ayres has been associated with his present firm of Ayres, Lewis, Norris, and May, consulting engineers in the fields of power, water works, sewerage, and sewage treatment. From 1923 to 1930 he was a consulting engineer to the City of Detroit, Department of Water Supply, from inception to completion of a project for additional water supply, including a new river intake, cross-town tunnel, and the Springwells pumping stations and filtration plant, and the development of a metropolitan distribution system. From 1926 to 1930 he was a consulting engineer to the City of Detroit, Department of Public Works, on storm-water pumping and sewage treatment, and his firm designed the Connors Creek storm water pumping station on East Jefferson Avenue in Detroit. During recent years Mr. Ayres' firm has been engaged in the design and construction of water, steam, and diesel power plants, and sewage-treatment and water-softening plants. He is now consultant to the Tennessee Valley Authority on condemnation of water rights on the Hiwassee River for the Fowler Bend Dam.

Louis E. Ayres
Nominee for Director, District 7

Mr. Ayres was elected a Junior in the Society in 1908, an Associate Member in 1913, and a Member in 1925. He is a member of several other technical societies and a former president of the Michigan Engineering Society and of the Detroit Section of the American Society of Civil Engineers.

WILFORD W. DE BERARD

WILFORD W. DE BERARD was born at Fairfax, Iowa, on October 31, 1874, and was graduated from Beloit College (Wis.) in 1896 and from Massachusetts Institute of Technology in 1901. For the three years after leaving Beloit he was bacteriologist and chemist for the Denver Union Water Company, building the first laboratory for water analysis west of Chicago. After graduating from Massachusetts Institute of Technology, he started on the engineer's nomadic quest for experience, working less than two years in a place until 1910 when he became Western editor of the *Engineering Record* (now *Engineering News-Record*) at Chicago. Several of these years were spent on special filtration experiments at the Philadelphia Testing Station and at Oakland, Calif. At the latter place he inaugurated the first experiments on water filtration on the Pacific Coast, which were expected at that time to lead to the construction of a filter plant larger than any yet constructed. Financial difficulties intervened and the work was not carried out.



W. W. DE BERARD
Nominee for Director, District 8

In addition to experimental work, Mr. De Berard had a part in the design, construction, and operation of the filter plant at Harrisburg, Pa., and in the design of the Columbus water and sewage treatment plants. He was with the U. S. Reclamation Service on the Sacramento Valley Investigations (recently included in the Central Valley Projects). He was on the staff of the Metropolitan Sewerage Commission of New York City, when he accepted editorial work in Chicago. He has continued in the latter work to date, except for the year 1926–1927, when he was loaned to the Chicago Regional Planning Association as its chief engineer, and for a few months when he was loaned to the Sanitary District of Chicago to act as a member of the Board of Review considering the lake-level controversy.

In civic matters Mr. De Berard has to his credit four years of service as village trustee in his home town of Wilmette, a suburb of Chicago, during which he acted as chairman of the water and sewer committee and obtained from the Reconstruction Finance Corporation one of its first loans for a new water-works and filtration plant. For many years he has been an active member of the Chicago Association of Commerce committees, especially on good roads and street traffic.

In the Western Society of Engineers his activities included a directorship and vice-presidency; in the Chicago Engineers' Club, a directorship; in the American Association of Engineers, a vice-presidency; in the American Water Works Association, membership on the water-works practice and publication committees; and in the American Public Works Association, a directorship (active in promoting the amalgamation of the two predecessors of the association). His activities in the American Society of Civil Engineers have included chairmanship of the Illinois Section and of the City Planning Division, and more recently he has served as a member of the Committee on Principles to Control Governmental Expenditures for Public Works of the Engineering-Economics and Finance Division.

J. EUGENE ROOT

J. EUGENE ROOT was born at Bellwood, Pa., on September 21, 1879. His educational training was acquired in the Bellwood public schools, the Iron City Business College (Pittsburgh), and the Pennsylvania State College. He was graduated from Pennsylvania State College in 1907 with the degree of B.S. in C.E., and in 1911 he received the degree of C.E. from the same institution.

In 1907, immediately following graduation, Mr. Root accepted a position in the maintenance engineer's office of the Pennsylvania Lines west of Pittsburgh, located at Logansport, Ind. In September of that year he went to Tucson, Ariz., as a computer in the construction engineer's office in charge of new railroad work between Nogales, Ariz., and Guadalajara, Mexico. From September 1908 to April 1912, he served as an instructor in civil engineering at the University of Cincinnati, and from April 1912 to May 1918 was an assistant engineer in the sewer division of the Engineering Department of the City of Cincinnati. During this interim he was one of the staff who worked on, and prepared, a report (published in December 1913) on a comprehensive sewerage plan for the City of Cincinnati. Later he was in charge of the design of sewers and interceptors for the city. From May 1918 until December 1927 Mr. Root was with the city of Akron (Ohio) as chief engineer of the Department of Sewers. Work accomplished under his direction and supervision included investigations, surveys, and plans for, and the construction of, relief sewers, new sewers, and a system of intercepting sewers, together with a sewage-treatment plant having a capacity of 35,000,000 gal daily. From January 1928 to December 1930 he was special engineer in charge of coordination for the planning and construction of the Cincinnati Union Terminal, and from January 1931 to the present time he has been director of the Department of Public Works of the City of Cincinnati.

JOSEPH E. ROOT
Nominee for Director, District 9

For some years Mr. Root has been active in local, state, and national organizations relating to his profession. He is past-president of the Engineers' Club of Cincinnati, the Cincinnati Chapter of the Ohio Society of Professional Engineers, and the International Association of Public Works Officials; vice-president of the Municipal Section of the American Road Builders' Association; and president of the American Public Works Association for 1937–1938. Mr. Root joined the American Society of Civil Engineers as an Associate Member in 1913, and his transfer to the grade of Member was approved in 1918. He has served as president of the Cincinnati Section of the Society.

His activities have also extended into civic life, and he has membership in the Cincinnati Club, the Kenwood Country Club, the Masons, and Scottish Rite and Grotto. He served as one of the committee in the preparation of several bills for the registration of engineers, which were introduced into the state legislature, and as one of the committee that drafted the present Ohio registration law for engineers and surveyors, which became effective in August 1935.

ROSS K. TIFFANY

ROSS K. TIFFANY was born at Union, Iowa, on June 11, 1879. After attending grade and high school there, he entered Cornell College (Iowa). He graduated in 1901, receiving the degree of B.S. in civil engineering, and in 1905 he was awarded the degree of C.E. by the same institution. In 1899 Mr. Tiffany spent six months on railroad location and construction at Snake River Canyon in eastern Oregon, and in 1901 he was employed by the St. Louis and New Oreleans Railroad on railroad location in Missouri and Illinois.

From 1901 to 1920 Mr. Tiffany was engaged in irrigation operation and construction in the Yakima Valley in Washington—first as engineer and, later, as manager for the Washington Irrigation Company; and then as superintendent of irrigation and, finally, as project manager for the U. S. Bureau of Reclamation in charge of the Yakima Project. In 1920 he became project manager on irrigation development in the Spokane Valley, continuing in this capacity until 1925. During this period he also served as consultant on many irrigation and drainage projects in Washington, Idaho, and Montana.

Ross K. Tiffany
Nominee for Director, District 12

In 1925 Mr. Tiffany was appointed Washington State Hydraulic Engineer, resigning in 1929 to engage in private practice as consultant in irrigation, power, and drainage developments. He served as works manager of the Washington Emergency Relief Administration in 1933, and from 1934 to the present time he has been executive officer for the Washington State Planning Council.

Mr. Tiffany has been active in the affairs of the Society since 1920, when he became a Member. For five years he was a member of the Society's Irrigation Division, and for one year he was chairman of the Division. He has also served as president of the Tacoma Section. His other professional activities include membership on the Hoover Commission on Conservation and Administration of the Public Domain. He is also a former president of the Washington Irrigation Institute.

Thomas R. Agg

Thomas R. Agg was born in Fairfield, Iowa, on May 17, 1878. He was graduated from Iowa State College in 1905, with the degree of bachelor of science in electrical engineering. In 1914 he received the degree of civil engineer. From 1905 until 1908 he taught in the engineering college at the University of Illinois—in the engineering drawing department for a year and the remainder of the time in the department of theoretical and applied mechanics.

From 1908 until 1913 Dean Agg was a member of the staff of the Illinois Highway Department, being successively assigned to construction, research, and design. In 1913 he returned to the teaching field as professor of civil engineering at Iowa State College in charge of instruction and research in highway engineering. This work expanded rapidly and was his principal interest until 1931. He was made assistant dean of engineering at Iowa State College in 1931, and upon Dean Marston's retirement in 1932 was made dean of engineering and director of the Iowa Engineering Experiment Station.

Thomas R. Agg
Nominee for Director, District 16

During the World War Dean Agg served, first, as a captain with the 109th Engineers and, later, as a major in command of the 98th Engineer Special Service Batallion. At present he is a lieutenant colonel in the Engineer Officers Reserve Corps.

From 1920 to 1926 Dean Agg acted as consulting road engineer for the Iowa Highway Commission, and for ten years (1924–1934) he was highway research specialist for the Bureau of Public Roads. He is the author of numerous research bulletins and of many papers that have appeared in scientific and technical journals. He has also written several books. *Construction of Roads and Pavements* was first published in 1916, and a fifth revision is now in preparation; *Highway Administration and Finance*, of which Dr. John E. Brindley was co-author, appeared in 1927; *The Preparation of Engineering Reports*, of which the late W. L. Foster, M. Am. Soc. C. E., was co-author, appeared in 1935; and *Engineering Valuation*, of which he was co-author with Dean Marston, was published in 1936. In 1936 he was the recipient of the George S. Bartlett Award for "outstanding contributions to highway progress."

Dean Agg was, from the time of its organization, enthusiastic about the contribution the Highway Research Board could make toward highway progress and has participated in its work throughout its existence. He has been a member of its executive committee since 1924. This year he is president of the Iowa Engineering Society. He became a Member of the Society in 1920 and for many years has been active in the work of the Iowa Section.

Symposium on Cost of Power Scheduled for Annual Meeting

In line with the changing general attitude as to importance of power, and, in particular, the great emphasis that has recently been placed on the part which power is taking in the economical and social development of the country, the policy of the Society's Power Division is gradually changing. The nearly exclusive field of activity in the past involved the purely technical aspects of hydro developments. Lately the economic problems are becoming of such importance that they cannot be neglected.

The first attempt to bring the economic phases of energy generation into proper relation with engineering problems was made during the October 1936 meeting in Pittsburgh, when a symposium on Economic Aspects of Energy Generation was held jointly by the Power and the Engineering-Economics and Finance Divisions. Arrangements have been completed to publish these six papers in the forthcoming December 1937 issue of Proceedings, previous to the January 1938 Annual Meeting, making this symposium available at this meeting. A résumé of these papers appears in the "Preview of Proceedings" in this issue.

As a logical continuation of this Pittsburgh symposium, but with particular emphasis on factual data, it is planned to hold a symposium on "Cost of Power" at the Annual Meeting. The desire is to develop a properly balanced symposium of considerable interest and to present papers and discussions of such importance that they can be used in the future in formulating definite conclusions and perhaps even recommendations.

An important step in clarifying the power situation is to bring before an engineering audience the viewpoints of engineers connected with different branches of the federal government. Therefore, particular effort has been made to induce leading government engineers to take part in the symposium.

Papers by outstanding engineers have been selected as follows:

Symposium on Cost of Power

1. Elements of Power Cost
2. Cost of Heat-Generated Energy
3. Cost of Hydro-Generated Energy
4. Cost of Combined Energy Generation
5. Cost of Depreciation and Obsolescence in Power Generation
6. Closing Paper

The Committee on Power Cost, under the chairmanship of W. F. Uhl, M. Am. Soc. C.E., is in charge of this symposium. It is making every effort to have these papers properly correlated, and in particular to have the subject matter of the symposium and the contents of all papers summarized in the closing paper expertly and without bias.

In the Pittsburgh symposium economists were invited to present the two closing papers. In the New York symposium all papers will be presented by engineers, but arrangements are being made to have the closing paper discussed by outstanding economists.

James W. Rickey, M. Am. Soc. C.E., chairman of the Power Division, who has supplied the preceding information, expresses the hope "that by arranging a number of consecutive symposia the continuity of the Power Division's policy will be preserved, and its usefulness to members and to the profession in general will be enhanced."

Alfred Noble Prize for 1937 to G. M. L. Sommerman

Announcement is made by the Joint Committee on the Alfred Noble Prize, with the approval of the Society's Executive Committee, of the selection of the winner of the prize for this year. The award is to go to G. M. L. Sommerman, member of the American

Institute of Electrical Engineers, for his paper, "Properties of Saturants for Paper-Insulated Cables," published in the May 1937 issue of *Electrical Engineering*. The prize is expected to be presented to the recipient during the annual winter convention of the American Institute of Electrical Engineers, to be held January 24–29, 1938.

Mr. Sommerman is research engineer for the American Steel and Wire Company at Worcester, Mass. His paper is described as a clear and concise presentation of the actual results of a careful experimental investigation so conducted as to take cognizance of and to correlate all important chemical, physical, and electrical tests which have been suggested by various investigators over the past decade for judging the suitability of saturants for paper insulation.

The recipient of the Alfred Noble Prize is selected by a committee of five, consisting of one representative each of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the Western Society of Engineers. The award is based upon papers published within the twelve months preceding July 15 of each year, and is made to a member of any grade of any of the societies listed, for a technical paper of particular merit accepted by the publication committee for publication, provided the author, at the time the paper is accepted in practically its final form, is not over thirty years of age.

The prize was established in 1929 for the purpose of perpetuating the name and achievements of Alfred Noble, Past-President of the American Society of Civil Engineers and of the Western Society of Engineers. It consists of the sum of $500 in cash and of a certificate signed by the President and Secretary of the Society (which acts as trustee of the fund), bearing the names of the various societies participating. The certificate is accompanied by a letter signed by the President of the Society, with a statement of the significant facts relating to the life and works of Alfred Noble. The award to Mr. Sommerman is the fifth made to date. In 1933 the award went to a civil engineer, Claude Maxwell Stanley, Jr., for his paper "Study of Stilling-Basin Design," published in the 1932 volume of PROCEEDINGS.

Committee on Land Surveys and Titles Maps Course of Action

THE NEWLY organized Joint Committee on Land Surveys and Titles got actively under way with a meeting at Boston on October 7, 1937. The following resolution, adopted at the close of the meeting, outlines the proposed course of action:

"*Resolved:* That this committee undertake an inquiry as to the experience of those states of the Union which have adopted land title registration in any form;

"That this committee then directly recommend to the legislature of every state which has not adopted land title registration consideration of the subject.

"That at least these features be included in the system recommended to new states:

a. A special court
b. An engineering department
c. Some specific official to be in charge of administration
d. No permitted withdrawal of registered titles
e. A procedural outline

"That this committee include in its first report a comprehensive statement of the movement to establish official plane coordinate systems in the United States; and that it approves in connection with the use of plane coordinates the principle that reference thereto be incorporated in deed descriptions only by reference to plan, and not by word description."

Informally, the committee agreed that the chairmen (Philip Kissam, M. Am. Soc. C.E., and Dor Viele, Member of the American Bar Association, should parcel out among the members the task of investigating the present status of title registration in the various states in which it is practiced or permitted, including all available information concerning the success or absence thereof in its operation.

The value of a separate Land Court, with competent legal and engineering personnel, was stressed in discussion by Charles E. Houghton, one of the American Bar Association's representatives on the committee. Such a court, he indicated, is essential to a satisfactory system of title registration. Fees for registration should not be so large as to be prohibitive, and public benefit resulting from registration warrants the public in paying a portion of the cost. The court should not only select its title examiners, in place of permitting any attorney to serve, but it should also select or designate engineers regarded as being competent to make the required surveys and plans.

Organization of the Joint Committee was completed with the selection of Dorr Viele of the Bar Association as joint chairman, and A. H. Holt, M. Am. Soc. C.E., as secretary. The personnel was listed in the October issue of CIVIL ENGINEERING.

John Fritz Gold Medal Awarded to Paul Dyer Merica

PAUL DYER MERICA, director of research of the International Nickel Company and vice-president of the International Nickel Company of Canada, has been awarded the 1938 John Fritz Gold Medal, highest of American engineering honors, for "important contributions to the development of alloys for industrial uses." The medal will be presented in New York, N.Y., at the annual meeting of the American Institute of Mining and Metallurgical Engineers in February 1938.

The award is made annually for notable scientific or industrial achievement by a board composed of representatives of the four Founder Societies. It was established in 1902 by friends of the late John Fritz, Hon. M. Am. Soc. C.E., to perpetuate the memory of his achievements in industrial progress.

The citation of the board points out that Dr. Merica's extensive research in theoretical and practical metallurgy has increased scientific knowledge in both ferrous and non-ferrous fields. It continues, "He has contributed generously to the science of metals, his work having covered the magnetic mechanical properties of steel; railway materials; failure of brass; the constitution, manufacture, and application of light alloy of aluminum; heat treatment of cast aluminum alloys; the precipitation theory of hardening of metals; and nickel and nickel alloys."

Among the 33 previous recipients of the John Fritz Medal have been the scientists Lord Kelvin, Thomas Edison, Guglielmo Marconi, and Michael I. Pupin; and seven civil engineers, all members of the Society—Alfred Noble, J. Waldo Smith, George W. Goethals, John F. Stevens, Ralph Modjeski, John R. Freeman, and Arthur N. Talbot.

Officers Elected by United Engineering Trustees

UNITED ENGINEERING TRUSTEES, at its recent annual meeting, elected as president D. Robert Yarnall, chief engineer of the Yarnall-Waring Company of Philadelphia, Pa. Albert Roberts and Henry A. Lardner were chosen vice-presidents. H. R. Woodrow becomes treasurer to succeed Mr. Roberts, and J. P. H. Perry, M. Am. Soc. C.E., was named assistant treasurer. John H. R. Arms, general manager of the Trustees, continues as secretary. In this connection the Society elected Mr. Perry, John P. Hogan, and Otis E. Hovey, Members Am. Soc. C.E., to serve as trustees.

Founded by charter in 1904 "to advance the engineering arts and sciences in all their branches, to further research in science and engineering, to maintain a free public engineering library, and to advance in any other manner the profession of engineering and the good of mankind," the United Engineering Trustees administer properties valued at $4,000,000, consisting of the Engineering Societies Building, Engineering Societies Library, and endowment funds which the corporation holds jointly for the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, and American Institute of Electrical Engineers.

Through the Engineering Foundation, the Library Board, and the Administrative Department, the Trustees aid research in engineering and the sciences, operate the Engineering Societies Library, which is the largest strictly engineering library in America, and carry on many other activities.

Early Presidents of the Society

XXI. Octave Chanute, 1832–1910

President of the Society, 1891

It is encouraging to note the interest of readers in supplying photographs and personal anecdotes for this series of sketches. Such cooperation is necessary for the preparation of informative, accurate, and readable articles, and is sincerely appreciated by the editors. The subjects of the next three installments will be Mendes Cohen, William Metcalf, and William Price Craighill.

One evening in 1891 Octave Chanute was dining with friends in Kansas City. The talk turned to hobbies, and Chanute remarked that every man should have one.

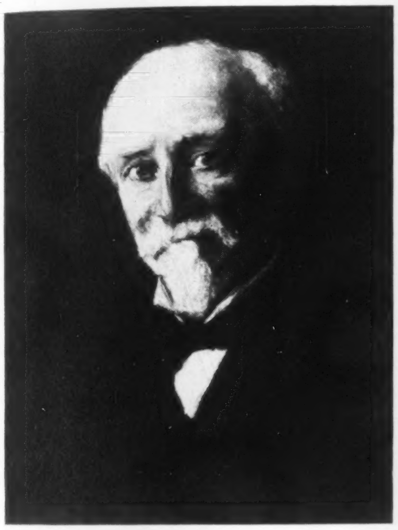
"What is yours?" inquired his host.

Chanute smiled. "Wait until your children are not present," he said, "for they would laugh at me."

After the children had gone to bed the question was repeated, and Chanute replied:

"My hobby is flying-machines—and I guess I would spend twenty-four hours a day working on them if my family would let me."

Chanute was then almost sixty, and one of the ranking civil engineers of the country. Yet in the years that followed, the hobby he rode so hard—and so literally—brought him a lasting fame that has overshadowed his earlier achievements. In the field of aeronautics he stands as the direct and vital link between Lilienthal and the Wright brothers, without which, as Wilbur Wright has said, "the entire history of progress in flying would have been other than it has been."



Octave Chanute
Twenty-first President of the Society

Octave Chanute was born in Paris, France, on February 18, 1832. The family came to the United States about six years later, when his father was chosen as vice-president of Jefferson College, in Louisiana, and in 1844 they moved to New York.

At 17, Chanute set out to look for work. He introduced himself to a resident engineer on the Hudson River Railroad, asked for a job, was told there were no vacancies, and countered with the proposal that he would serve without pay as a chainman. He was accepted somewhat reluctantly, but within two months he went on the regular payroll at $1.12½ a day. This "position," incidentally, was the first and the last he ever applied for. From then on, he was continuously engaged on one project or another without ever having to solicit employment.

It is hardly necessary in so brief a sketch to follow the details of his thirty-odd years of railroad work. Suffice it to say that it included a period as chief engineer of the Chicago and Alton (1863–1867), and ended with ten years as chief engineer of the Erie (1873–1883). A better picture of Chanute's career will be obtained by highlighting three of his major contributions—the construction of the first bridge over the Missouri River, his pioneer work in timber preservation, and his aeronautical studies.

Spanning the Missouri River is no mean feat today; in 1867 it was a project of the first magnitude. Currents of eight miles an hour, ice jams, rapid rises of 30 ft or more in stage, and a shifting bottom that may scour or build 20 ft overnight, conspire to test to the utmost the ingenuity and perseverance of the bridge builder. To add to the difficulties confronting Chanute, the Kansas City of that day was a frontier town with but one small foundry and machine shop, and not a barge suitable to carry stone could be found on the river. Flat boats, dredges, and pile drivers had to be built, and special tools had to be designed, all as a preliminary to the actual work of building the bridge.

"From the inception of the work," wrote Chanute, "the subject of foundations was the paramount study of the engineers, the only real difficulties of the task lying below the water. The methods of founding which have been in most common use in the United States were not to be thought of, as the continual wash and scour of the river would have made piles and crib-work useless, while the great depth and rapid current must[would] have rendered cofferdams very hazardous and expensive. . . . It was also found that in the absence of pneumatic plant in America, and with the then high prices of iron work, the pneumatic process would prove an unreasonably expensive one."

Chanute's description of the construction of Pier 4 is illustrative of the originality employed throughout the work: "The rock was assumed to be overlaid, during the best working season, with about 40 ft of sand, which would probably make it necessary to do some portions of the work in 50 ft of water. A plan was prepared resembling in many respects the process which was first introduced in founding the piers of the bridge over the Rhine at Kehl, and which has since been very generally employed by European engineers; in all previous works, however, the excavation had been made by laborers working in a pneumatic chamber; but in these plans the machinery was so arranged as to be self-feeding, and the excavation was carried on without the use of compressed air. A pier of masonry was to be built in position above water, and sunk to the rock, by excavating the underlying sand with dredges [buckets on an endless belt] working through wells left in the masonry, guiding the mass in its descent by suspension screws, and keeping the top of the masonry above the surface of the water by building on the successive courses as the sinking continued."

The apparatus is shown in an accompanying illustration. The caisson, of timber, was 20 ft in width (as shown) and 70 ft long. Sixty piles supported the falsework, the principal feature of which was a series of seven trusses carrying suspension screws that connected with rods on the sides of the caisson. Once in place, the spaces between the double walls of the caisson were filled with "beton" (concrete) to increase its weight, and the lowering, controlled by the suspension screws, was begun. Four dredges, like the one shown in section, were used.

After the caisson had been seated on rock, divers were sent down to clean the surface and make sure that the "beton," placed by self-tripping wooden buckets, was "packed in well toward the edges." There was no rock excavation. The final step, of course was the completion of the masonry above water; this presented no difficulties.

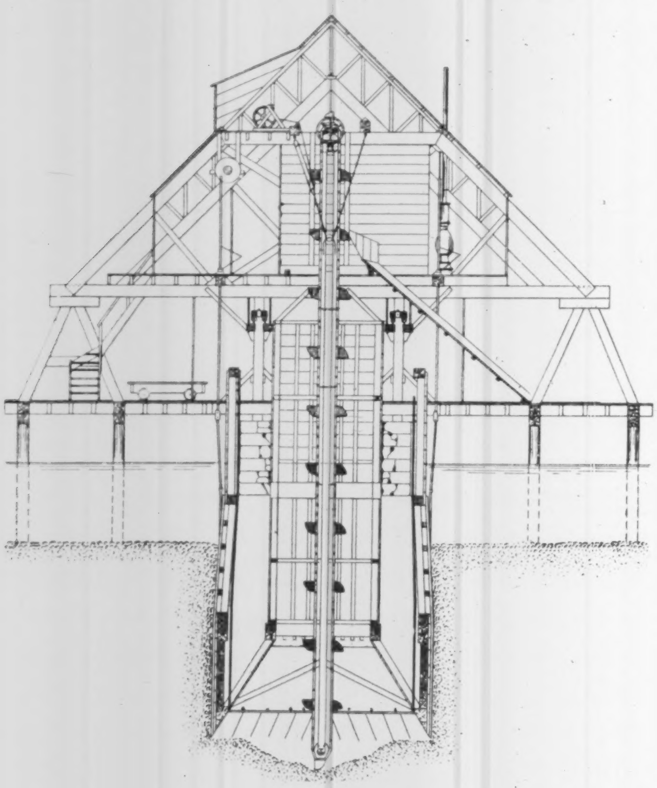
A variety of other methods, contrived to fit the individual requirements, were used in founding the other piers. The bridge was completed in 1869, and lasted until about 1917, when it was rebuilt as a steel structure. Its strategic importance is illustrated by the fact that it "united the three railroads on the north and east side of the river with the four on the south and west, made Kansas City the convenient point of exchange for all business going southwesterly, and gave it such commercial importance as wellnigh to justify the boast of its sanguine citizens, that it was destined to become the metropolis of the Southwest."

Chanute's fame as a bridge builder was thoroughly established by this project, and brought him in later years commissions to construct the bridges over the Missouri River at Sibley, Mo. (Sante Fé Railroad, 1888; rebuilt 1914); the bridge over the Mississippi River at Fort Madison, Iowa; and numerous crossings of smaller streams.

During the 1870's the increasing price of lumber in many parts of the United States made it evident that several of the sources of supply were rapidly being exhausted, and that it would soon be economically feasible, if not actually necessary, to adopt some preservative treatment to lengthen the life of ties and structural timbers. In 1880 the Society appointed a committee, with Chanute as chairman, to investigate the subject—particularly to ascertain which methods of preserving timber against decay were most successful, and which were best adapted to the needs and current practice in this country.

The investigation occupied five years, and culminated in a report

(Transactions, Vol. XIV) that was long the authority on the subject. As late as 1929 it was reprinted by the American Creosoting Company, together with another paper by Chanute on the preservation of railroad ties, and a third by Sir Samuel Boulton of England. The three treatises were jointly referred to as "classics in the literature of wood preservation," and as one of the most important influences in promoting the large-scale practice of wood preservation in this country.



Cross-Sectional View of Caisson and Equipment Used for Constructing a Pier of First Bridge Over Missouri River
From *The Kansas City Bridge*, by Octave Chanute and George Morison, 1870

When the committee began its work, it was met with indifference on the part of many engineers who were still willing to let timber rot "in the good old way." There had been many isolated experiments in the preceding thirty years, but practically all of them had been abandoned because the benefits had not been commensurate with the cost. Some of the larger railroads, for example, had set up treatment plants and tried out modifications of methods that had already been used in Europe for many years. But processes that had been successful abroad were unsuccessful here—largely because the Europeans operated chiefly on seasoned timber, while American builders used freshly cut material that required different handling.

Finally, the committee succeeded in assembling data on 147 experiments. The information was very confusing; the facts seemed to contradict each other; and for details it was usually necessary to rely not on written records but on personal recollections. But out of this maze of conflicting, incomplete reports, and an extended study of European methods, Chanute and his fellow workers produced a thoroughly practical report that awoke the profession to the importance of the subject and laid the foundation for a new industry. Almost immediately after its publication, a number of railroads called on Chanute to build plants for wood preservation, and by the turn of the century the processes of creosoting, Kyanizing, and Burnettizing were thoroughly established in the United States.

As early as 1874 Chanute became interested in aviation, but it was in 1889, when he moved to Chicago, that he first took up the problem seriously. He engaged in an extensive correspondence with men all over the world who were interested in the subject, and collected and systematized all the important data from experiments of the preceding two centuries. In each case Chanute added his own elucidation of the principles involved, gave his opinion on the causes of failure, and pointed out the probable direction in which improvement might be expected. The results of this work were first published as a series of magazine articles entitled "Progress in Flying Machines," beginning in 1891, and republished in book form in 1894. This publication was of the greatest importance to the advancement of the art.

In 1896 he began actual gliding experiments on the shore of Lake Michigan. The following splendid account of this and later work is quoted from *A History of Aircraft*, by F. Alexander Magoun and Eric Hodgins (McGraw-Hill Book Company, 1931), pages 269–274:

"Lilienthal was still alive and practicing his art in Germany, but Chanute was strongly of the opinion that Lilienthal's best machine was hazardous and that his rudimentary idea of maneuvering by alteration of body position should be superseded by a more scientific system. Some mechanism, he felt, should be provided to adjust the wings automatically. The operator, to Chanute's mind, should remain seated in the machine and intervene only to steer. Realizing that comparatively little could be learned of this through the use of models, he straightway began experimentation with full-scale machines. But Chanute's age disqualified him from any extensive participation in the experiments. He was personally able to perform short glides only.

"The first site he chose for the attempts of himself and his assistants was a 95-ft hill but he soon substituted for this one of 61 ft. During 1896 and 1897, Chanute, with a staff of between four and six men, including A. M. Herring and W. Avery, tried out five full-sized gliders. From his designs two definite types evolved; one a biplane, the other the famous quinqueplane—a machine of five tiers of wings, provided with a steering tail. Chanute's first enthusiasm was entirely for the latter craft and did not diminish until experiment showed that neither in safety nor in efficiency was it an improvement over the biplane.

"One of Chanute's most valuable achievements was in taking a series of photographs showing consecutive phases of a single flight. This series of photographs represented the experiences gained in a total of 1,000 glides. Chanute's best result appears to have been a glide of 360 ft with a descent ratio of 1:6. The average speed attained with the biplane was between 22 and 30 miles per hour, but it once rose as high as 52 miles per hour. Chanute experimented successfully in winds up to a velocity of 31 miles per hour.

"Chanute's biplane was of such stability that he could occasionally permit amateurs to operate it. Unlike so many of his experimental predecessors, his record was never marred by serious accident. He none the less recognized the 'spice of danger' which gliding entailed and advised work over water to break a possible fall. He predicted that once the hazards of the art had been eliminated, 'gliding will become a popular sport.'

"Aeronautical history is indebted to Chanute (as to Lilienthal, Pilcher, and later to the Wright brothers) for working assiduously toward the control of stability without attempting too early to rush the process of evolution by applying power. Having begun a new series of aeronautical contributions in 1896 by strongly advising students of flight to study full-scale, man-carrying gliders as the quickest and surest way to success, Chanute went on to a more detailed description of the problems involved. In his mind these problems concerned: 1. The resistance and supporting power of air. 2. The motor, its character and its energy. 3. The instrument for obtaining propulsion. 4. The form and kind of the apparatus. 5. The extent of the sustaining surfaces. 6. The material and texture of the apparatus. 7. Maintenance of the equilibrium. 8. Guidance in any desired direction. 9. Starting up under all conditions. 10. Alighting safely anywhere. Of these Chanute concluded that 7 was by far the most important and, consequently, it was to the problem of equilibrium that he directed his researches . . . .

"Chanute was, despite his lengthy experiments, content not to attempt solution of every problem in aeronautics at one stroke. He wrote:

"'It [the successful commercial machine] will, in my judgment, be worked out by a process of evolution: one experimenter finding his way a certain distance into the labyrinth, the next penetrating further, and so on, until the very center is reached and success is won.'

"Toward the conclusion of his work and some time before the Wright brothers had begun active experimentation, he said:

"'Flying machines promise better results as to speed, but yet will be of limited commercial application. They may carry mails and reach other inaccessible places, but they cannot compete with railroads as carriers of passengers or freight. They will not fill the heavens with commerce, abolish custom houses, or revolutionize the world, for they will be expensive for the loads which they can carry, and subject to too many weather contingencies. Success is, however, probable.'

"Nothing that has yet happened in the three decades that have now gone by since those words were uttered has voided this remarkable prophecy."

Chanute eventually abandoned his gliding experiments and devoted himself to further theoretical research. All of his research and experimentation was made in a genuinely scientific spirit and at his own expense, free to all who were interested, and without any thought of pecuniary benefit to himself. After his death, the Aero Club of Washington, linking his name with those of Lilienthal, Langley, and Maxim, said:

"These four men elevated an inquiry, which for years had been classed with such absurdities as the finding of perpetual motion and the squaring of the circle, to the dignity of a legitimate engineering pursuit."

Chanute's other activities can be given only passing mention. His design of the union stock yards at Chicago and Kansas City is of interest in pointing out the wide variety of problems he attacked. His work as chairman of the executive committee of engineering societies in charge of the International Engineering Congress at the Columbian Exhibition in Chicago illustrates his ability as organizer and administrator. The account of his trip to China to investigate a railroad project for J. P. Morgan, and the subsequent dénouement when the Empress was warned by a dragon in a dream to beware of foreigners, would make an interesting tale in itself.

"It might be supposed, since Chanute's activities were largely in the pioneering development of the Middle West, that he would be of the 'rugged individualist' type, as usually understood," said Robert P. Woods, M. Am. Soc. C.E., in an address last year before the Kansas City Section. "But he was not. On the contrary it was his nature to be mild, considerate of others, kindly, generous, patient, and just. Yet while almost self-effacing in his manner, it was recognized by all with whom he came in contact that he was a tremendous thinker and doer, with intense tenacity of purpose and determination."

Chanute was married in 1857 to Miss Anne Reddell James of Peoria, Ill., who died in 1902. His own death occurred November 23, 1910, and he was survived by a son and three daughters.

He held memberships in the leading engineering and technical educational societies of the United States, England, Canada, France, and Chile. Special mention should be made of the Western Society of Engineers, with which his contacts were perhaps the closest. He was its president in 1901 and became an honorary member in 1909. He endowed the Chanute medal, still awarded annually by that society for the best papers on civil, mechanical, and electrical engineering subjects.

Chanute served as President of the Society in 1891.

[Acknowledgment is due Robert P. Woods, M. Am. Soc. C.E., for supplying interesting personal anecdotes used in the above account; also the McGraw-Hill Company, for permission to reproduce excerpts from *A History of Aircraft*.]

All Members on Society Committees

The number of busy engineers who gladly accept official responsibility on Society committees is imposing and inspiring. The work involved is sometimes overwhelming and occasionally discouraging; and the rewards to the individual are intangible and frequently measured mostly in satisfaction for a good job well done. Yet there is an abundance of evidence that the membership of the Society is constantly alert to opportunities for cooperative effort.

Through its Divisions and committees, the Society acts as a vast clearing house of technical and professional information. Therefore all members in all grades should consider themselves members of all committees to the extent that they can contribute to the common stock of information.

As an example of such help that is needed, a significant call has been received from J. Stuart Crandall, M. Am. Soc. C.E., member of the Committee of the Waterways Division on the Bearing Value of Pile Foundations:

"Wherever piles are being driven with a drop-hammer it is hoped that those in charge will take the time to accurately determine the penetration for say three blows for each of four different heights of fall for one or two piles, and send this information, with other pertinent data, dimensions of piles, type of soil, etc., to the Committee on the Bearing Value of Pile Foundations. Penetration should be measured accurately with a leveling instrument to 0.01 ft and the drop made to the nearest 0.1 ft. If a driving cap is used, it should be fully described."

This active committee, now under the chairmanship of R. E. Bakenhus, M. Am. Soc. C.E., has been gathering data in its field for nearly 14 years. Such faithfulness to an important objective deserves the cooperation of every engineer and field assistant engaged in pile-driving operations.

The same general plea for objective interest on the part of the entire membership is made in behalf of each of the 200 technical and professional committees of the Society, with their total official membership of more than 1,200 engineers.

Index for 1937 in This Issue

At the end of this issue appears the index for the current volume of Civil Engineering, covering the issues from January through December 1937. As a matter of convenience it is included as a separate printed form, which can be removed intact by loosening the binding staples. It thus becomes available for filing or for binding in the yearly volume. With the latter idea in mind, the first page of the index has been designed to make a title page for the bound volume.

The index is as complete as it has been possible to make it in the space available. Every article and item has been included, a large percentage of them appearing under two or more headings, so that any desired article can be located quickly even though the searcher may recall only its general subject matter.

To make such an index possible of issue with the last number of the volume covered is no small task. All during the year material has been collected and collated at Headquarters, so that the cumulative index for the year has been more or less up to date at all times. At the last moment, with the paging of this December number determined, the necessary final data have been inserted, and the whole set-up has been reviewed editorially and approved for publication. In spite of the extensive labor and expense involved, this index easily justifies itself as a valuable and up-to-the-minute technical service to members.

Separate reprints of the index may be had from Headquarters, 33 West 39th Street, New York, N.Y., at 15 cents a copy.

Appointments of Society Representatives

Harland Bartholomew, Howard W. Green, Arthur P. Greensfelder, and Harold M. Lewis, Members Am. Soc. C.E., were appointed Society delegates to the Conference on Residential Construction of the U. S. Chamber of Commerce, held in Washington, D.C., on November 17 and 18.

Louis C. Hill, President Am. Soc. C.E., has accepted appointment as the Society's representative on the John Fritz Medal Board of Award.

John P. Hogan, M. Am. Soc. C.E., was appointed to represent the Society at the Congress of Engineers, held during the exposition in Paris, France, September 26–29, 1937.

L. G. Rucquoi, M. Am. Soc. C.E., was appointed the Society's delegate at the ceremonies of the centenary of the founding of the School of Mines at the University of Liege and the inauguration of the new Institute of Val Benoit, held at Liege, Belgium, in November.

Paul W. Thompson, Jun. Am. Soc. C.E., has been appointed to serve on the Society's Special Committee on Hydraulic Research.

American Engineering Council

The Washington Embassy for Engineers, the National Representative of a Large Number of National, State, and Local Engineering Societies Located in 40 States

A PUBLIC-WORKS DEPARTMENT

ENGINEERS have advocated a Public Works Department for many years, and now that the President's Committee on Administrative Management, composed of Louis Brownlow, Charles E. Merriam, and Luther Gulick, has also recommended such a department, engineers are encouraged to believe that the proposal may be due for serious consideration by this next session of Congress. It is not likely to be without opposition, however, because even the Brookings Institution (which made a study for Senator Byrd's committee) failed to support the idea, although it did recommend many changes in public works and engineering functions.

The President's committee came to the conclusion that such a department should "advise the President with regard to public works" and that it should be prepared "to design, construct, and maintain large-scale public works, which are not incidental to the normal work of other departments, except as their agent on request; to administer federal grants, if any, to state and local governments, or other agencies for construction purposes; and to gather information with regard to public works standard throughout the nation. . . . The committee does not assign to the new department particular agencies and bureaus, but leaves this assignment to the Executive when, and if, the Congress enacts a law setting up the general departmental structure."

American Engineering Council is anxious to help to unite engineers in their public responsibility with reference to public-works activities undertaken by the federal government, the several states, and local committees. To that end, engineers and engineering organizations are invited to express themselves to the A.E.C. public works committee through its office.

As a premise, one nationally known consulting engineer with a vast amount of practical experience in the construction field has suggested that "those activities of a civilian character should be allocated to such a public-works department, and those for defense by the Army and Navy should remain as they are." In that connection, it has been said that "in the interest of simplicity, for the association of related activities to effect a reduction in overhead costs, for the elimination of duplication, to provide opportunities for a technical personnel of the highest type, and to facilitate the planning of government financial programs the federal government should have that concentration of public-works activities which has already proven satisfactory in our states and municipalities and in the more progressive foreign countries."

Definite recommendations for a Public Works Department are to have consideration during the Eighteenth Annual Meeting of the American Engineering Council's Assembly in Washington on January 13, 14, and 15, 1938. Special studies by the staff and a comprehensive report of the A.E.C. public works committee regarding the structure of a Public Works Department are to be ready for discussion at that time.

SCIENTIFIC RESEARCH LEGISLATION

American Engineering Council has appointed a special committee to consider the ramifications of Congressman Randolph's H.R. 7939 for the promotion and coordination of scientific research activities as a means for the prevention of unemployment in the future. Although the Randolph Bill has not come up for action in Congress and is still subject to change, it has aroused much interest among members of the engineering profession. A number of engineers have already filed criticisms and suggestions, and Randolph informs us that he is anxious to have reactions representing all fields of technology. Council has not formulated an official policy with reference to this legislation but the following observations are made available for the convenience of engineers and engineering organizations:

"In essence, Congressman Randolph proposes that instead of having a variety of research projects carried on by government bureaus and special research agencies seeking government funds in an unplanned way for their particular projects, that these various efforts be coordinated through the establishment of an advisory board made up of representatives of the government, of scientists, and of industry. That approach to the problem has appealed to this organization.

"Last year the land-grant colleges introduced a bill proposing the establishment of engineering experiment stations in each state paralleling in general the agricultural experiment-station idea. Since the land-grant act is administered through the Agricultural Department, the land-grant colleges believe that any development of such experiment stations should be so administered. Meanwhile, the state colleges in 19 states. . . sought to have this bill modified so that money could be spent at state colleges as well. . . . In this proposal, the administrative machinery would be located in the Bureau of Standards of the U. S. Department of Commerce.

"A third bill confused the issue further by proposing a plan for government expenditures in the field of business research, this one to be headed up in the Department of Commerce. . . . Meanwhile, of course, certain government bureaus, like the Bureau of Standards and the Bureau of Mines, seek money for fundamental research, and sometimes the regular functions of the government in their research efforts are confused with the proposals outlined above. So far, it has been impossible to secure a meeting of minds between the college groups. . . .

"It seems that Congressman Randolph is approaching this matter in a way in which some order might be brought out of this chaos. While American Engineering Council has not committed itself to any detail of the bills, we have been assisting Mr. Randolph in securing all the information he can from all the sources, so he will have before him as complete a picture of the problem as possible before he revises his bill. . . ."

ACCURATE MAPS AND PUBLIC WORKS

In response to an invitation from the Federal Board of Surveys and Maps, American Engineering Council, through its surveys and maps committee, has prepared the following statement to be used by a special committee in an effort to have the "mapping agencies" seek additional appropriations from Congress for the acceleration of basic mapping under the Temple Act during the fiscal year ending June 30, 1939.

"American Engineering Council has for many years vigorously supported the requests of our member engineering organizations that the basic map of the United States be completed at the earliest possible date, and, as a move in the right direction, has accepted, in principle, the recommendations made by Secretary Ickes in response to Senate Resolution 281, which requested a program for expediting the topographic mapping of the United States. The recommendations involve a 20-year program and the expenditure of $100,000,000. They would give the Geological Survey $4,000,000 for topographic surveys and maps, and the Coast and Geodetic Survey $1,000,000 for first- and second-order control surveys in 1938 under such items as the directors of the Surveys may designate. The surveys and maps committee of American Engineering Council earnestly hopes that steps will be taken by the Bureau of the Budget and the Congress to appropriate the minimum of five million dollars that is called for in this program. . . .

"No previous national administration has more consistently proven the value and need of a basic mapping program. The work of the National Resources Committee and of its various subcommittees, the aggressive development of soil conservation, the programs of land control and utilization, the planned approach to the wide use of our natural resources, the control of flood waters—all depend in detail on the basic map as an essential tool. Maps are the very first requirement of the committee, board, or individual who plans or designs public or private works of any kind. . . .

"These principles have been stated over and over again during the last several years by committees of American Engineering Council and of its member engineering societies. . . . In addition, many other scientific and technical agencies have supported the need of an adequate mapping program. . . . This very considerable body of technical opinion, expressed both by map users and map makers, is united as to the need. The committee believes that the proposal of the Federal Board of Surveys and Maps has the earnest support of all agencies interested. . . .

"Further, the committee, in supporting this first step towards an adequate mapping program, perceives it as only the beginning of a long-desired objective and earnestly hopes that every effort will be made to carry out the complete plan with additional appropriations annually of such size as will complete a basic map for the United States at the earliest possible date. . . ."

Free Competition or National Planning?

Engineer-statesmen are advisedly asking what is to be the next step after national planning. Mr. Leonard J. Fletcher, who is chairman of the A.E.C. committee on the conservation and utilization of natural resources and a member of the A.E.C. engineering economics committee, has made the following statement:

"The next step after national planning is plan enforcement. Plan enforcement and free competition cannot exist together—it is one or the other.

"With a people accustomed to exercising independent thought and action in their business and personal affairs, free competition is a mysterious force that. . . .displaces the inefficient, and allows the introduction of new inventions to proceed at just the right pace . . . . If the privilege of free competition is curtailed through the activities of a central planning board, even though its members be promoted by the highest of ideals, one of the most valuable possessions of the people of this country will be destroyed."

Planning as an "operational" function of management is accepted by engineers as inherent in the successful administration of public or private enterprise. Planning in the broad sense of determining the "strategies of civilization," and the determination of national policies for present or future generations of citizens, has not yet been considered realistic by most engineers.

Annual Meeting of A.E.C.

The Eighteenth Annual Assembly of the American Engineering Council and the Eight Annual Conference of Secretaries of Engineering Associations, Clubs, Councils, Institutes, and Societies in the United States are scheduled for January 13, 14, and 15, 1938. The meetings are to be held at the Hotel Mayflower in Washington, D.C. A number of problems of common concern to the engineering and allied technical professions are being considered by the committees, and the programs, which include the All Engineers' Dinner, are expected to hold unusual interest for all branches of engineering.

Washington, D.C.
November 4, 1937

Monthly Earnings of Professional Engineers, 1929–1934

This is the sixth of a series of articles covering the results of the Survey of the Engineering Profession made in 1935 by the Federal Bureau of Labor Statistics at the request of American Engineering Council. It is abstracted from a report of the same title by Andrew Fraser, Jr., of the Labor Bureau.

Previous articles of the series were published in "Civil Engineering" in August 1936, and in February, May, June, and September 1937.

In 1929, the range in monthly engineering earnings of professional engineers was very great. Some 79 engineers reported earnings of less than $60 per month, while 168 earned more than $1,880 a month. The median monthly earnings of the 28,511 reporting engineers was $289. One-quarter earned more than $415, while only 10 per cent had earnings greater than $609 a month.

Between 1929 and 1934 there were progressive declines in monthly engineering earnings. While the sharpest absolute decreases occurred at the higher levels of earnings, the greatest percentage decreases took place at the lower earnings levels. Almost two-thirds of the decreases occurred between 1929 and 1932.

Comparison of earnings by the five professional classes, without regard to age, shows that in 1929 the upper 10 per cent of mining and metallurgical engineers reported the highest earnings, of not less than $792 per month, as against $515 a month for civil engineers, the lowest earnings. For the upper 25 per cent of the reporting engineers the order of the professional classes was the same, monthly engineering earnings ranging from not less than $372 for civil engineers to not less than $503 a month for mining and metallurgical engineers. At the middle and lower earnings levels, the differences in earning capacities of the five professional classes were less marked, although mining and metallurgical engineers still occupied the upper extreme. At these levels the electrical engineers were the lowest-paid class. These and other similar data are shown in Table I.

For men of identical ages in 1929, 1932, and 1934, the survey re-

Table I. Comparison of Five Levels of Monthly Engineering Earnings for All Engineers Reporting in Each Professional Class in 1929, 1932, and 1934

Figures Derived from Adjusted Data, and Without Regard to Kind of Engineering Employment Reported or Type of Education

Per Cent of Professional Class at Specified Earnings Level*	Monthly Engineering Earnings of More Than Specified Amount			Amount of Decrease			Per Cent of Decrease		
	1929	1932	1934	1929–1934	1929–1932	1932–1934	1929–1934	1929–1932	1932–1934
10 per cent:									
Mining and metallurgical	$792	$585	$524	$268	$207	$61	33.8	26.1	10.4
Chemical and ceramic	732	579	509	223	153	70	30.5	20.9	12.1
Mechanical and industrial	674	512	441	233	162	71	34.6	24.0	13.9
Electrical	587	496	463	124	91	33	21.1	15.5	6.7
Civil, agricultural, and architectural	515	430	390	125	85	40	24.3	16.5	9.3
25 per cent:									
Mining and metallurgical	503	409	371	132	94	38	26.2	18.7	9.3
Chemical and ceramic	490	400	339	151	90	61	30.8	18.4	15.2
Mechanical and industrial	455	356	313	142	99	43	31.2	21.8	12.1
Electrical	405	336	315	90	69	21	22.2	17.0	6.2
Civil, agricultural, and architectural	372	311	279	93	61	32	25.0	16.4	10.3
50 per cent:									
Mining and metallurgical	334	274	241	93	60	33	27.8	18.0	12.0
Chemical and ceramic	326	251	203	123	75	48	37.7	23.0	19.1
Mechanical and industrial	311	246	215	96	65	31	30.9	20.9	12.6
Civil, agricultural, and architectural	277	229	205	72	48	24	26.0	17.3	10.5
Electrical	275	232	215	60	43	17	21.8	15.6	7.3
75 per cent:									
Mining and metallurgical	241	183	154	87	58	29	36.1	24.1	15.8
Mechanical and industrial	225	166	145	80	59	21	35.6	26.2	12.7
Chemical and ceramic	221	157	131	90	64	26	40.7	29.0	16.6
Civil, agricultural, and architectural	213	169	150	63	44	19	29.6	20.7	11.2
Electrical	201	163	148	53	38	15	26.4	18.9	9.2
90 per cent:									
Mining and metallurgical	186	125	115	71	61	10	38.2	32.8	8.0
Civil, agricultural, and architectural	167	126	120	47	41	6	28.1	24.6	4.8
Mechanical and industrial	167	122	107	60	45	15	35.9	26.9	12.3
Chemical and ceramic	156	116	101	55	40	15	35.3	25.6	12.9
Electrical	148	123	108	40	25	15	27.0	16.9	12.2

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* Arranged in ascension of monthly engineering earnings for 1929.

vealed that the greatest impact of the depression, as far as engineering earnings were concerned, fell upon men with from two to five years' experience.

Although the 1929 data on engineering earnings evidence an advantage in favor of men who have engineering degrees, this advantage was less clearly defined than was the case with earned annual incomes. However, the extra years of experience which the "other" engineers had while the graduates were in school permitted of their obtaining higher earnings than graduates only up to a point corresponding to five years after graduation. Even at two years after graduation the differentials in earnings between the two groups were slight. With advancing age there was a considerable advantage in engineering earnings in favor of the graduates, and the monthly engineering earnings of graduates continued to increase several years beyond the point of maximum earnings of "other" engineers. The earnings of the latter either remained stable or declined at 30 years after graduation. These data are summarized in Table II.

TABLE II. MEDIAN MONTHLY ENGINEERING EARNINGS IN 1929, 1932, AND 1934, FOR ALL ENGINEERS REPORTING BY AGE AND TYPE OF EDUCATION

Without Regard to Kind of Engineering Employment Reported

					First-Degree Engineering Graduates					Others with: College Course Incomplete		Others with: Noncollegiate Technical Course		
Age	Year of Graduation	Years After Graduation	Post-graduates	Non-Engineering Graduates	Chemical and Ceramic	Civil, Agricultural, and Architectural	Electrical	Mechanical and Industrial	Mining and Metallurgical	Civil, Agricultural, and Architectural	Mechanical and All Others	Civil, Agricultural, and Architectural	Mechanical and All Others	Secondary School Education
								1929 earnings (in dollars)						
64 and over	*	41+	†	480	†	408	†	410	440	310	440	†	†	320
56–63	1889–96	33–40	484	493	510	424	484	506	493	315	420	347	380	360
48–55	1897–04	25–32	455	482	493	407	438	483	437	318	423	286	402	353
40–47	1905–12	17–24	421	414	523	358	428	440	458	302	401	293	354	308
36–39	1913–16	13–16	350	416	487	328	368	405	405	273	335	260	326	310
32–35	1917–20	9–12	307	335	395	305	338	337	370	257	319	254	290	275
28–31	1921–24	5–8	266	255	295	260	264	285	284	220	267	218	253	233
26–27	1925–26	3–4	220	224	236	220	213	224	235	204	215	210	211	192
24–25	1927–28	1–2	180	166	179	187	167	180	183	184	193	187	186	183
23	1929	0	145	152	150	155	137	141	156	166	178	160	150	160
								1932 earnings (in dollars)						
67 and over	*	44+	†	260	†	336	†	420	†	247	380	†	†	295
9–66	1889–96	36–43	435	400	†	367	415	416	420	273	335	267	300	311
51–58	1897–04	28–35	421	427	420	334	420	390	356	262	333	247	311	311
43–50	1905–12	20–27	365	384	443	307	353	351	374	258	326	249	289	273
39–42	1913–16	16–19	318	353	418	289	330	327	314	235	284	232	270	265
35–38	1917–20	12–15	294	305	324	262	309	301	300	226	263	222	244	234
31–34	1921–24	8–11	249	245	273	232	243	250	239	206	228	193	209	212
29–30	1925–26	6–7	220	227	223	208	202	211	206	187	189	180	180	173
27–28	1927–28	4–5	188	190	185	187	178	175	162	168	174	154	156	168
26	1929	3	157	149	149	164	152	152	149	149	148	163	150	130
25	1930	2	142	149	144	149	136	137	143	156	133	167	140	150
24	1931	1	119	120	124	134	118	120	114	145	131	†	135	140
23	1932	0	110	†	108	116	103	106	97	143	127	†	†	†
								1934 earnings (in dollars)						
69 and over	*	46+	†	250	†	306	†	330	†	210	310	†	†	280
61–68	1889–96	38–45	376	370	†	331	408	370	400	257	300	256	227	283
53–60	1897–04	30–37	386	387	426	296	379	346	340	240	320	220	297	298
45–52	1905–12	22–29	339	353	425	285	349	333	347	236	301	227	261	252
41–44	1913–16	18–21	299	384	350	263	333	303	302	218	254	208	247	254
37–40	1917–20	14–17	279	305	340	244	300	283	311	201	247	199	228	229
33–36	1921–24	10–13	241	242	287	218	240	239	237	183	216	183	198	198
31–32	1925–26	8–9	217	208	228	198	205	207	207	166	184	158	180	162
29–30	1927–28	6–7	186	197	198	179	180	180	183	156	170	142	159	153
28	1929	5	166	164	170	163	162	165	153	145	153	160	150	134
27	1930	4	144	145	153	150	145	149	143	145	135	155	133	150
26	1931	3	137	131	134	143	127	132	143	137	145	110	131	153
25	1932	2	123	130	122	131	114	118	120	124	136	†	113	†
24	1933	1	120	123	114	126	109	110	118	126	117	†	138	†
23	1934	0	95	130	107	116	106	106	113	118	107	110	108	110

* Prior to 1889. † Fewer than 10 engineers reported.

Manual of Underground Utilities

CULMINATING six years of continuous and active effort, the Committee of the City Planning Division on Location of Underground Utilities is presenting a manual on this subject which will be in the hands of members within the next few weeks. Plans for the initiation of this work were first discussed at the meeting of the City Planning Division in New York, N.Y., on January 23, 1931. Subsequently, the following experts in this field were appointed to serve as a committee on the preparation of the manuscript: W. W. Horner, Nathan B. Jacobs, Henry H. Krantz, and the late Paul E. Green, Members Am. Soc. C.E.; George E. Loughland, Assoc. M. Am. Soc. C.E.; and Arthur W. Consoer, M. Am. Soc. C.E., acting as chairman. Mr. Green died on March 12, 1937, and thus was prevented from participating in the final developments of this manual. All the remaining members, however, were constant in their interest and willingness to sacrifice valuable time to this effort. The report was also examined by numerous other interested engineers not members of this committee, including Hugh E. Young, W. W. DeBerard, and George H. Herrold, Members Am. Soc. C.E. These other engineers made many constructive suggestions which were utilized by the committee in formulating the manual.

In its formative stage, the manuscript passed through five tentative drafts as a result of its circulation among committee members and other advisers. The first official report was submitted to the executive committee of the Division in January 1935. During the succeeding year, it was circulated among the members of the executive committee, resubmitted to the Committee on Underground Utilities with detailed suggestions and comments, returned to the executive committee with the results of this review incorporated in the manuscript and, finally, approved by the executive committee on June 10, 1937. It was accepted for publication, on behalf of the Board of Direction, by the Committee on Publications on July 18, 1937.

The manual contains 28 guiding principles for the location of underground utilities, grouped broadly under three headings—general principles relating to the government organization of underground units, standards for recording data for the preparation of underground plans and for office practice, and general standards of design.

In the bibliography the references include a supplementary bulletin which will soon be available at Society Headquarters, 33 West 39th Street, New York, N. Y. This separate publication, entitled *Typical Plans and Forms for Use in Locating Underground Utilities*, was prepared in addition to the Manual, for the use of specialists in the field to which it applies. It will be distributed at a nominal charge when it has been prepared.

It is the hope of the Committee on Location of Underground Utilities that this manual will serve to stimulate activity on the important matters of properly recording data on existing subsurface utilities and of developing plans for future underground utilities of all types. All engineers who are concerned with subsurface work in city streets and suburban highways as well as men interested in city and regional planning will find much to interest them in the forthcoming *Manual of Underground Utilities*.

Structural Research Subcommittee Begins Active Work

The Subcommittee on Structural Research, recently organized by the Society's Structural Division to collect and correlate data on research programs, has assigned its members to definite geographical districts in order to facilitate its work. Each member will collect the information on structural research in progress in his district and will, in turn, keep the organizations and colleges of his district informed as to research activities throughout the country. The district assignments are given in Table I. With the exceptions and limitations indicated therein, they coincide with the Society Districts shown in Fig. 1.

The cooperation of all parties concerned should be of very considerable benefit. It is suggested that industrial organizations and colleges with programs to report or inquiries to make should communicate with the committee member in their district.

Table I. District Assignments of Members of Subcommittee on Structural Research

Districts*	Exceptions or Limitations	Committee Members
2	None	C. M. Spofford H. M. Westergaard John B. Wilbur
1	Except the British Empire	F. H. Frankland W. J. Krefeld Leon S. Moisseiff Harold E. Wessman
1	British Empire, outside of North America only	J. F. Baker
4	None	George E. Beggs Inge Lyse
5	Except District of Columbia	R. P. Davis
6	Except Pennsylvania	
10	None	
5	District of Columbia only	O. L. Grover H. L. Wittemore
6	Pennsylvania only	C. F. Goodrich
3	None	S. C. Hollister
7	None	R. H. Sherlock
12	None	
8	Chicago and surrounding counties only	G. A. Maney
8	Except Chicago and surrounding counties	N. M. Newmark
9	None	
16	Except Colorado	R. A. Caughey
14	None	
16	Colorado only	J. H. A. Brahtz C. L. Eckel
15	None	
11	None	Raymond E. Davis
13	None	

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* Numbers refer to Society Districts as shown in Fig. 1.

A detailed statement of the work the committee is undertaking appeared in Civil Engineering for October 1937 (page 715).

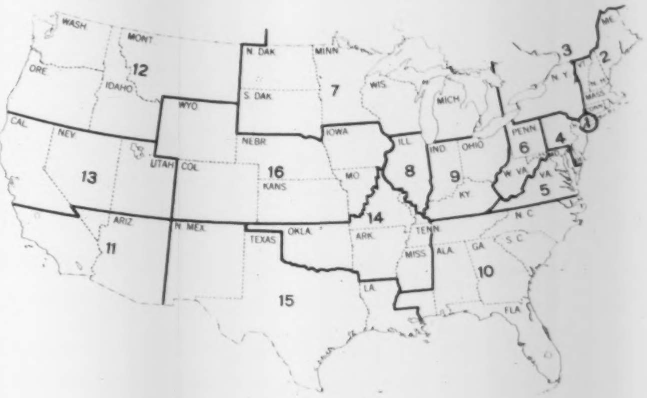


Fig. 1. Society District Boundaries

District 1 Includes All Members Within 50 miles of the Post Office of New York City, and All Members Outside North America

A. V. Karpov, chairman, states that offers of assistance are being received not only from members of the Society in the United States but from abroad as well. The inclusion of a member from Great Britain made it possible to have the British Empire, with the exception of Canada, included as a separate district.

Dutch Engineering Society Confers Honorary Membership on Secretary of the Society

At a general meeting held at The Hague on August 2, 1937, the Koninklÿk Instituut van Ingenieurs conferred honorary membership on George T. Seabury, M. Am. Soc. C.E. This award, the highest that the Institute can bestow, was given in recognition of his helpful attitude towards the Institute in his official capacity as Secretary of the Society.

A general meeting and dinner to celebrate the Institute's ninetieth anniversary took place at The Hague on September 1, 1937. On this occasion Avan Royen, president of the Institute, presented the diplomas of honorary membership. Since Mr. Seabury was unable to be present, his diploma was awarded in absentia.

Doubtless this distinction is not only a personal recognition of Secretary Seabury but is also intended as an expression of esteem for the Society.

A Mail-Order Library

In the year ending September 30, 1937, over 10,000 persons from all parts of the world made use of the Engineering Societies Library by mail or phone. This is in addition to the 27,000 readers who actually visited the Library itself.

Requests for information have come from regions as remote as New Zealand and South Africa, from practically every state, from most countries of Europe, and from the Far East. In his annual report Harrison W. Craver, secretary of the Library board, states:

"The Library is becoming more and more a bureau of engineering information with a clientele that is not only national, but world wide. Every effort is made to handle questions intelligently and helpfully. In the case of members without access to libraries or other sources of information, special effort is made to furnish adequate answers or guidance."

At present, according to this report, the Library contains 141,292 volumes, 7,330 maps, 4,362 manuscript bibliographies, and 3,701 pamphlets. The lending collection contains 600 volumes. Gifts and purchases during the year amounted to 11,000 pieces.

"Effort has been made," the report continues, "to add all new books and periodicals in our field that seemed to be useful to members. As the occasions when the desired book cannot be supplied are few, it is judged that this effort has been successful."

Preview of Proceedings

By HAROLD T. LARSEN, *Editor*

Energy generation, economic pipe sizes, earthquake stresses in dam design, soil analyses, and tests on grit chamber models are new subjects to be opened for discussion in the December issue of "Proceedings." The discussion on papers that have been current since last April will also occupy a large part of the allotted space. The subject index and the author index of material published during the year will close this number and Vol. 63 of "Proceedings."

SYMPOSIUM ON ECONOMIC ASPECTS OF ENERGY GENERATION

Social and political aspects of power problems are becoming constantly more important. On the one side are the proponents of increased government participation in power production and distribution; on the other, the advocates of private initiative. A perhaps more basic controversy divides those who would subsidize certain "uneconomical" markets from those who demand that each extension of power service justify itself on a strictly dollars-and-cents basis.

Obviously, a discussion of power economics from the engineer's point of view must today include other than technical factors. Similarly, the development of an intelligent power policy, though it may rest largely in the hands of non-technical men, must be predicated on a clear understanding of engineering trends. Engineers, economists, and social planners should all find interest, therefore, in the present symposium. The original papers were read at the technical sessions sponsored jointly by the Power Division and the Engineering-Economics and Finance Division on October 14, 1936, at the Society's Fall Meeting in Pittsburgh.

The trend of power costs has long been slowly but definitely downward. The technical advances that have made this trend possible are traced in the first three papers—"Progress in the Generation of Energy by Heat Engines," by George A. Orrok, M. Am. Soc. C.E.; "Hydro-Generation of Energy," by Frank H. Rogers, Esq.; and "Improvements in the Utilization of Energy," by Joel D. Justin, M. Am. Soc. C.E. Next, the principal factors in the cost of power are discussed, emphasis being placed on the relative economy of hydro and steam plants. The paper treating this subject is "Cost of Generation of Electric Energy," by Philip Sporn, Esq. In the concluding papers social questions are taken up. Does increased use of power mean permanent unemployment? Does cheap transmission tend to decentralize industry? What part should government take in subsidy or control? The titles and authors of these contributions are "Social Implications of Technological Trends in the Power Industry," by Prof. Ralph A. Freeman, and "Electric Power in Economic Perspective," by Prof. B. Alden Thresher.

ECONOMIC PIPE SIZES FOR WATER DISTRIBUTION SYSTEMS

The answer to the question as to the proper sizes of pipes in a water distribution system, for best economy, is given in a paper entitled "Economic Pipe Sizes for Water Distribution Systems" by Thomas R. Camp, M. Am. Soc. C.E.

The theory is developed and explained for both gravity systems and pumped supplies. The latter are considered in terms of four basic cases: (1) pumped supplies with constant discharge; (2) pumped supplies with varying demand and varying pumping head (there are no storage tanks in case two); (3) pumped supplies with varying demand and constant pumping head (elevated storage tanks situated near the pumps); and (4) pumped supplies with varying demand and varying pumping head, with elevated storage tanks situated at points remote from the pumps.

Professor Camp purposely avoids discussing economic pipe sizes in terms of economic velocity, although many engineers have become accustomed to thinking of economic pipe sizes in such terms.

EARTHQUAKE STRESSES IN AN ARCH DAM

The design of circular arch dams by modern methods had its beginning in the pioneer work of the late William Cain, M. Am. Soc. C.E. In 1932, George E. Goodall and Ivan M. Nelidov, Associate Members Am. Soc. C.E., presented a paper on stresses in inclined arches of multiple-arch dams, carrying forward the work of Mr. Cain into this field. The forthcoming paper by Mr. Nelidov and Harold E. Von Bergen, Assoc. M. Am. Soc. C.E., entitled "Earthquake Stresses in an Arch Dam" is projecting the equations of the Goodall-Nelidov paper one step further.

The early paper supplied algebraic formulas covering the case of the particular variable load which results from an inclining arch, as in a multiple-arch dam. In the forthcoming paper, mathematical formulas are derived for the computation of earthquake effect on arch dams, particularly as they apply to the multiple-arch form. Although this paper is highly technical and somewhat mathematical, it is brief, and those who have an interest in this branch of engineering design will find much of value in it.

GRAPHICAL REPRESENTATION OF THE MECHANICAL ANALYSES OF SOILS

A study of various methods of classifying soils is presented in a paper entitled "Graphical Representation of the Mechanical Analyses of Soils" by Frank C. Campbell, Assoc. M. Am. Soc. C.E.

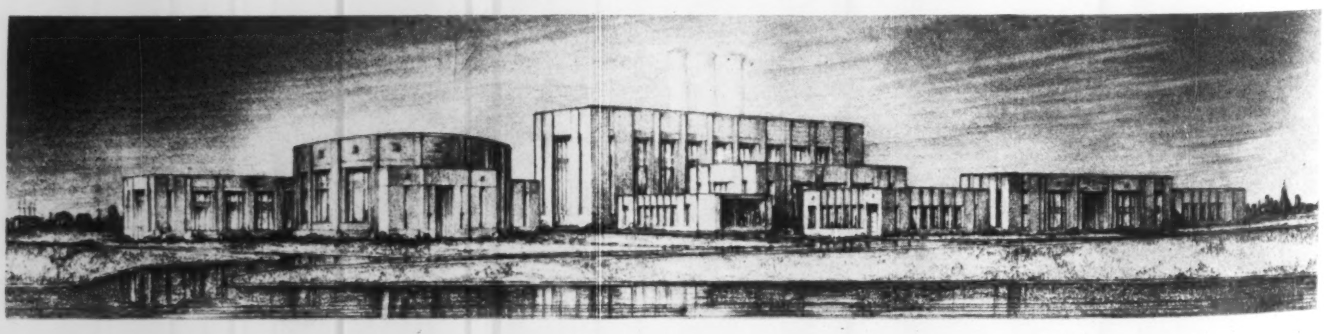
After a discussion of the methods now in use, Mr. Campbell proposes a unified system, similar in some respects to that developed by the Bureau of Chemistry and Soils, U. S. Department of Agriculture. This system involves semi-logarithmic coordinates with the grain sizes spotted as abscissas on a logarithmic scale and cumulative percentages by weight spotted as ordinates. The author suggests three new ideas as follows: an indication of the history of a soil by the concavity or convexity of its grain distribution curves; the use of a decimal scale to indicate gradation; and a proposed soil classification scale. Being unusually brief, this paper can be read and fairly digested within an hour.

GRIT CHAMBER MODEL TESTS, FOR DETROIT SEWAGE TREATMENT PROJECT

Hydraulic engineers as well as municipal and sanitary engineers will wish to examine carefully the data and conclusions offered by George E. Hubbell, Esq., concerning the phenomena of sand settling in flowing water. The tests were made during an investigation to determine certain features in the design of grit chambers to form a part of a sewage disposal project for Detroit, Mich.

Mr. Hubbell concludes, for instance, that an effective depth of 15 ft will be most suitable for the removal of grit. Curves are included to show the settling time, the percentage of sand of various sizes removed in two existing grit chambers, as well as the expected removal of sand in the grit chambers that are yet to be constructed.

The paper is concise and clear and offers some important and new information in this field.



ARCHITECT'S RENDERING OF NEW SEWAGE DISPOSAL PLANT AT DETROIT, MICH.

News of Local Sections

Scheduled Meetings

Buffalo Section—Luncheon meeting at the Buffalo Athletic Club on Dec. 14, at 12:15 p.m.

Central Ohio Section—Annual dinner meeting at the Faculty Club, Ohio State University on Dec. 16. (A joint meeting with the Ohio State University Student Chapter.)

Cleveland Section—Regular luncheon meeting at the Chamber of Commerce on Dec. 7, at 12:15 p.m.

Colorado Section—Dinner meeting at the University Club in Denver on Dec. 13, at 6:30 p.m.

Kansas City (Mo.) Section—Annual meeting on Dec. 21, at 6:30 p.m.

Lehigh Valley Section—Meeting at Lehigh University on Dec. 13, at 8 p.m.

Los Angeles Section—Ladies' Night dinner on Dec. 8, at 7 p.m.

Metropolitan Section—Regular meeting at the Engineering Societies Building in New York on Dec. 15, at 8 p.m.

Nashville Section—Dinner meeting in Kissam Hall at Vanderbilt University on Dec. 7, at 6:30 p.m.

Philadelphia Section—Meeting and dinner at the Engineers' Club on Dec. 15, at 6:00 p.m.

Pittsburgh Section—Monthly meeting at the William Penn Hotel on Dec. 3, at 8 p.m. (A joint meeting with the Engineering Society of Western Pennsylvania.)

Puerto Rico Section—Regular meeting at the American Railroad Company's Building on Dec. 14, at 8:30 p.m.

Sacramento Section—Regular luncheon meetings at the Elks Club every Tuesday, at 12:10 p.m.

San Francisco Section—Dinner meeting at the Engineers' Club, on Dec. 21.

Spokane Section—Luncheon meeting at the Crescent Tea Room on Dec. 10, at 12 m.

Tacoma Section—Dinner meeting at the Tacoma Hotel on Dec. 13, at 6:30 p.m.

Tennessee Valley Section—Dinner meeting of the Knoxville Sub-Section at the University of Tennessee Cafeteria on Dec. 2, at 6:00 p.m.

Texas Section—Luncheon meeting of the Dallas Branch at the Dallas Athletic Club on Dec. 6, at 12:15 p.m.; luncheon meeting of the Fort Worth Branch at the Blackstone Hotel on Dec. 11, at 12 m.

Recent Activities

Central Illinois Section

On October 13 the Central Illinois Section resumed its schedule of monthly dinner meetings. After dinner, which was held at the Inman Hotel in Champaign, J. J. Doland, professor of civil engineering at the University of Illinois, gave a résumé of the Drainage Basin Report of the National Resources Committee for District 7A, comprising the headwaters of the Mississippi River. The enthusiastic discussion following the report indicated considerable interest in the subject. There were 29 present.

Central Ohio Section

Members of the Central Ohio Section met at the Chittenden Hotel in Columbus on October 13 for their monthly luncheon. There were 24 present on this occasion to hear the guest speaker, Charles P. Hoover, superintendent of the Columbus Water Filtration Plant. Mr. Hoover, who is an international authority on water treatment, discussed some of the problems of water treatment and how they are solved.

Cleveland Section

The November meeting of the Cleveland Section took place in the club rooms of the Cleveland Chamber of Commerce on November 9. Following luncheon, a talk on the subject of transportation was given by E. J. Burkhardt, aviation development engineer for the Standard Oil Company of Ohio. Mr. Burkhardt covered his topic by giving a résumé of aeronautical developments.

Connecticut Section

On October 26 the Connecticut Section held a dinner meeting at the Yale Faculty Club in New Haven in honor of Hardy Cross, newly appointed head of the department of civil engineering at Yale University. There were 36 present to hear Professor Cross speak on the subject of "Educational Trends." In his talk Professor Cross emphasized the fact that civil engineering is a fundamental science and that civil engineering problems are not going to change fundamentally, although engineering curricula will naturally require revision and rearrangement from time to time. He also discussed the problems involved in graduate study. Professor Cross was introduced by John Tracy, retiring head of the department of civil engineering at Yale University. The speeches of welcome included greetings from Robert Cairns, representing the state of Connecticut, and Clarence Blakeslee, who welcomed him in behalf of the city of New Haven.

Detroit Section

The annual election of officers for the Detroit Section took place at a meeting held at the Hotel Statler on October 19, the results being as follows: Robert L. McNamee, president; Milo F. Ohr, first vice-president; Chester L. Allen, second vice-president; and L. C. Wilcoxen, secretary-treasurer. Following the business session, there was a talk by Frederick C. Taylor, director of highway planning for the Michigan State Highway Department. The list of 68 present included Henry Earle Riggs, official nominee for President of the Society.

Hawaii Section

The Hawaii Section of the Society held its inaugural dinner and meeting at the Pacific Club in Honolulu on October 27, with 38 present. Following dinner there was a brief business session, during which numerous communications from Society Headquarters were read. Among the guests of honor was Ben Moreell, who has recently been promoted to the rank of rear admiral, C.E.C., U. S. Navy, and who is leaving Hawaii to assume his new duties as chief of the Bureau of Yards and Docks in Washington, D.C. The speakers were R. S. Thomas, colonel, Corps of Engineers, U. S. Army, who is engineer of the Hawaiian Division and commanding officer of the Third Engineers; and A. R. Keller, vice-president of the University of Hawaii and dean of the college of engineering. Colonel Thomas described the construction of over 50 miles of military roads and trails, which have just been built with government funds on the island of Oahu, while Dean Keller gave an illustrated lecture on engineering structures that he found of interest on a recent trip around the world.

Ithaca Section

The Ithaca Section met for its October meeting in Willard Straight Hall on the campus of Cornell University on October 21. After a short business session during which officers for the coming year were elected, certificates of life membership in the Society were presented to C. E. Curtis, H. N. Ogden, and H. W. Preston in person, and to J. F. Witmer in absentia. Then W. G. Atwood, consulting engineer of Ithaca, N.Y., gave a lecture on transportation in Europe after the war. Colonel Atwood's experiences as manager of rail transportation in Europe for the American Relief Administration and as American transportation representative to the Supreme Economic Council in 1918 proved an excellent background for such a talk. The new officers are as follows: E. E. Stickney, president; P. H. Underwood, first vice-president; R. T. Lewis, second vice-president; and J. E. Perry, secretary-treasurer.

Kansas City (Mo.) Section

There were 50 members and guests present at a dinner meeting of the Kansas City Section held at the University Club on October 26. The speaker of the evening was Samuel J. Callahan, supervising engineer of the Kansas City Department of Public Works, who discussed the interesting features involved in the design and construction of the new City Hall. A representative of the Associated Charities Campaign then spoke, making a plea for funds in a forthcoming drive. The meeting concluded with a travelogue by Lawrence C. Anderson, which showed colored pictures of the ruins of the Cliff Dwellers at Mesa Verde in Colorado, Brice Canyon in Utah, and Boulder Dam. On October 28 Field Secretary Jessup was a visitor to the Kansas City Section. After conferences with the Section officers and luncheon with the Rotary Club, Mr. Jessup was driven to Jefferson City, Mo., where he attended the ceremony of organizing the Mid-Missouri Section of the Society.

KANSAS STATE SECTION

A dinner meeting of the Kansas State Section took place at the Hotel Kansan in Topeka on October 26. Following dinner and a brief business session, a short talk was given by I. C. Crawford, Director of the Society and dean of engineering at the University of Kansas. The address of the evening was given by Field Secretary Jessup, who discussed the new plan of allocating all members of the Society to some Local Section. His talk was followed by an enthusiastic discussion, and a motion to the effect that the area of influence of the Kansas State Section be the whole state was made and carried. The attendance was 41.

METROPOLITAN SECTION

Activities of the Metropolitan Section got under way on October 20 with a meeting in the Engineering Societies Building in New York City, which was attended by some 350 members and guests. The subject, "Recent Trends in Cement Technology and Their Effects on Engineering Construction," was presented by Dr. P. H. Bates, chief of the Clay and Silicate Products Division of the National Bureau of Standards, Washington, D.C. In accordance with the usual custom, refreshments were served at the close of the formal program.

The Junior Branch of the Metropolitan Section has held four meetings, the most recent being an open forum to debate the question: "Should the Young Engineer Join a Union?" A formal debate prepared by six Juniors was followed by discussion from the floor in which some 20 Juniors in the audience of 100 took part. The debaters were Eugene Quiriconi, Arthur Collard, George Curtis, Chester Dalzell, George Hayden, and Alan Lee Slaton. A brief concluding address was given by Van Tuyl Boughton, managing editor of the *Engineering News-Record*. Previous meetings of the Junior Branch this fall have included: "Licensing and Registration Procedure" (speaker, John C. Riedel, deputy chief engineer of the New York Board of Estimate and Apportionment); "How to Apply for a Job" (speaker, Harold Kiernan, of the New York State Employment Agency); and "Tunnel Work Under Compressed Air" (speakers, V. E. Dyer and J. E. Ure, both Juniors). The attendance at these meetings averaged about 75.

NEBRASKA SECTION

An interesting dinner meeting of the Nebraska Section took place at the Fontenelle Hotel in Omaha on October 12. The technical program consisted of the presentation of a paper on the engineering features of the Tri-County Project and the Keystone Dam by R. O. Green, assistant chief engineer of the Central Nebraska Public Power and Irrigation District; and the reading of a report detailing the latest developments in connection with the Nebraska State Engineers' and Architects' License Law. The report was read by D. L. Erickson, city engineer of Lincoln, Nebr. Then a certificate of life membership in the Society was presented to T. A. Leisen, Director of the Society. Colonel Leisen, who has been a member of the Society for forty years, recounted numerous interesting incidents in his engineering experience. A luncheon meeting of the Section was held at the Lincoln Hotel in Lincoln on October 16. This was a special meeting held in honor of Roy C. Gowdy, Vice-President of the Society, who gave a talk on the activities of the Society.

NEW MEXICO SECTION

Numerous business matters were discussed at a meeting of the New Mexico Section, held in Santa Fe on September 21. A committee was appointed to consider what action, if any, the Section will take in regard to the proposed Hayden-Ickes plan for a mapping program, and Prof. D. B. Jett, of New Mexico State College, briefly discussed arrangements for a forthcoming joint meeting of the Section and the New Mexico State College Student Chapter. The speaker of the evening was W. W. Hurlbut, an engineer in the Los Angeles Bureau of Water Works and Supply, who gave an illustrated talk on the Los Angeles water supply system and the Mono Basin Project.

NORTHWESTERN SECTION

The Minnesota Union Building in Minneapolis was the scene of a dinner meeting held by the Northwestern Section on October 14. There were 16 present at the dinner and business meeting, and 25 members of the Corps of Engineers, U. S. Army, came in later for the technical program. During the business session the following officers were nominated and unanimously elected: L. G. Straub, president; H. S. Loeffler, first vice-president; A. F. Meyer, second vice-president; and A. J. Duvall, secretary-treasurer. The annual reports of the secretary and treasurer were read and approved, and a committee was appointed to study and make recommendations on a report of the National Resources Committee on the Red River valley and upper Mississippi drainage basin. The technical program consisted of the presentation of a paper on the construction of the Fort Peck Project. This was given by Harry Lovering, president and treasurer of the Lovering-Longbotham Company, Inc., of St. Paul, who illustrated his remarks with a number of interesting photographs and drawings.

PHILADELPHIA SECTION

An unusually successful meeting initiated the 1937–1938 schedule of the Philadelphia Section. This session, which was a joint meeting with the Engineers' Club, took place on October 20. There was a record attendance of 165 at the dinner, and between 350 and 400 attended the technical meeting afterwards. The first speaker was C. M. Jones, Jr., assistant chief engineer in the bridge department of John A. Roebling's Sons Company, who showed a sound motion picture entitled "Bridging a Century." This picture, with its accompanying lecture, traced the development of the suspension principle in bridge construction. Then Jonathan Jones, chief engineer of fabricated steel construction for the Bethlehem Steel Company, described the production of the sound motion picture, "Building the Golden Gate Bridge," before showing the picture. Before the meeting adjourned Lyle F. Bellinger, Vice-President of the Society, gave a brief talk on the proposed plan to allocate all members of the Society to some Section. At the conclusion of the meeting refreshments were served. The program was arranged under the chairmanship of Lester L. Lessig.

PORTLAND (ORE.) SECTION

There were 44 present at a meeting of the Portland (Ore.) Section, which took place on October 13. The primary purpose of this meeting was to honor H. W. Dennis, Vice-President of the Society, who discussed Society affairs. However, occasion was also taken to honor J. C. Stevens, who has been awarded the Society's Norman Medal for 1937, and five members of the Section to whom certificates of life membership were presented. These were W. W. Amburn, Russell Chase, J. P. Newell, M. E. Reed, and E. B. Thomson. The final event on the program was Mr. Dennis' talk, which was followed by an interesting, informal discussion.

SACRAMENTO SECTION

Following its usual custom, the Sacramento Section continued to hold weekly luncheon meetings during October, with the exception of the 12th, which was a legal holiday. There were 73 present at the meeting that took place on October 5. On this occasion George Koch, of the San Francisco office of the Bethlehem Steel Company, presented a sound motion picture showing the manufacture of alloy steel. On October 19 the annual "Ladies Day" luncheon was enjoyed. The attendance of 120 included 58 ladies. Following luncheon and a greeting from the president, Thomas B. Waddell, a talk was given by F. Melvyn Lawson, vice-principal of the Sacramento Senior High School, whose topic was "The Price of Neutrality." After the meeting adjourned the ladies remained for an afternoon of bridge. "Modern Methods of Aerial Photography" was the subject of an illustrated lecture that was presented at the meeting held on October 26. The lecturer on this occasion was Bruce C. Hill, captain, Corps of Engineers, U. S. Army. There were 92 present.

SAN DIEGO SECTION

On October 21 a meeting of the San Diego Section took place at the Diner Cafe, with 19 present. The feature of the occasion was a talk by Tom J. Allen, resident engineer inspector for the PWA at San Francisco. Mr. Allen, who was engaged for two years on the construction of the San Francisco–Oakland Bay Bridge, described the various methods used in the instrument work and the problems encountered. His talk was followed by the monthly business meeting.

SAN FRANCISCO SECTION

During the past two months the San Francisco Section has participated in several interesting activities. On September 18 members of the Section enjoyed their annual dinner party, which took place at the Castlewood Country Club, with 173 members and guests in attendance. On September 25 an excursion was made to the plant of the Great Western Electro Chemical Company, at Pittsburg, Calif. After inspecting the various units of the plant, the 53 members present enjoyed luncheon as guests of the company. Another trip was taken on October 16, when 26 members of the Section visited the Marina Pumping Plant and the Richmond Tunnel of the San Francisco Sewage Disposal Project. This trip was sponsored by the Sanitary Committee of the Section. The regular bimonthly meeting of the Section took place on October 19, with 130 present. The program for this meeting, which was also arranged by the Sanitary Committee, consisted of an illustrated talk by A. M. Rawn, assistant chief engineer of the Los Angeles County Sanitation District, whose subject was "The County Sanitation District of Los Angeles County—the Record of a Planned Development."

TENNESSEE VALLEY SECTION

The Knoxville Sub-Section of the Tennessee Valley Section met at the University of Tennessee Cafeteria on October 5. This meeting was held in honor of the members of the Mass Concrete Sub-Committee of the American Concrete Institute; Raymond E. Davis, professor of civil engineering at the University of California; F. R. McMillan, director of research for the Portland Cement Association; and a representative of the U. S. Bureau of Reclamation. There were 65 present.

On September 16 the Muscle Shoals Sub-Section of the Tennessee Valley Section held a meeting at Wilson Dam, which was attended by 22. The speaker on this occasion was Oren Reed, assistant construction engineer for the Tennessee Valley Authority, who gave an illustrated talk on the subject of "Penstock and Surge Tanks for Hydroelectric Projects."

TEXAS SECTION

The annual meeting of the Texas Section, which took the form of a two-day session, was called to order in the ballroom of the Blackstone Hotel in Tyler, Tex., on October 15. The following speakers were listed on the technical program: O. H. Koch, consulting engineer of Dallas, Tex.; W. S. Hanley, chief engineer of the St. Louis Southwestern Railway Lines; James G. Lott, division engineer of the Texas State Highway Department; E. L. Kurth, manager of the Angelina County Lumber Company; Field Secretary Jessup; J. S. Hudnall, member of the American Association of Petroleum Geologists and of the Texas State Board of Registration for Professional Engineers; W. W. Trout, chairman of the Texas State Board of Registration for Professional Engineers; and A. J. McKenzie, who gave his final report as chairman of the Legislative Committee. Mr. McKenzie was presented with a desk set suitably inscribed as a token of the appreciation of engineers in Texas for his work. In the evening a dinner dance was enjoyed in the ballroom of the Blackstone. A number of brief after-dinner talks were given, and certificates of life membership in the Society were presented to R. A. Thompson and F. D. Hughes in person, and to John B. Hawley and T. U. Taylor in absentia. Following these ceremonies, a floor show was enjoyed through the courtesy of the Tyler Chamber of Commerce. The business meeting took place at breakfast on Saturday morning. At this time the following officers were nominated and elected for the ensuing year: J. T. L. McNew, president; R. J. Cummins and H. N. Roberts, vice-presidents; and John A. Focht, secretary-treasurer. The meeting then adjourned so that the members might motor to Fort Worth and to Austin to attend football games. The total attendance was 120.

WEST VIRGINIA SECTION

After several months of preliminary planning and study, 28 members of the Society met at the West Virginian Hotel in Bluefield, W.Va., on November 4, to organize the West Virginia Section of the Society. During the business session the following officers were elected for the coming year: C. P. Fortney, president; Burr H. Simpson and William Brewster, vice-presidents; Theodore A. Polansky, secretary-treasurer; and R. P. Davis, temporary director. The feature of the occasion was a talk by George T. Seabury, Secretary of the Society, who discussed the workings of the Society, the duties of the various departmental heads, and other matters of interest to the Section. His talk was followed by brief remarks by the newly elected Section officers, and A. E. McCaskey, Jr., G. P. Boomsliter, J. E. Settle, P. J. Walsh, Harry McGraw, F. C. Colcord, L. H. Hill, T. F. Boltz, Hugh L. Miller, and Robert Williamson. Certificates of life membership were then presented to William D. Sell in person, and to William M. Hall, Robert Hazlett, and W. S. Winn in absentia.

Student Chapter Notes

CASE SCHOOL OF APPLIED SCIENCE

The first formal meeting held by the Case School of Applied Science Student Chapter this year took place on October 7. The feature of the occasion was an illustrated lecture by Professor Donner, of the Case School and Western Reserve University, who described an African trip that he made several years ago. A recent letter from the Chapter states that there are 32 members and that the Chapter, in cooperation with the Cleveland Section of the Society, expects to have a very active year. The Chapter officers for the present year are R. Vanderhoof, president; H. Weiss, vice-president; and C. Carlson, secretary and treasurer.

KANSAS STATE COLLEGE

The Kansas State College Student Chapter held its first meeting of the present school year on September 16. This was primarily a business session, during which plans for the year were discussed. L. E. Conrad, professor of civil engineering at Kansas State College, led a discussion as to the merits of the senior inspection trip. The officers of the Section are as follows: John Bateman, president; Weldon Reagor, vice-president; Martin Pattison, secretary; and Max McCord, treasurer. On October 7 members of the Chapter enjoyed a successful smoker, which was attended by 82 students and members of the faculty. Brief talks were given by John W. Frazier, assistant engineer of bridge design for the Kansas State Highway Department, and Carl Morgan. Then Harold K. Howell, a member of the Chapter, showed a colored motion picture, which contained many features of interest to civil engineers. A smoker, social hour, and refreshments were enjoyed at the conclusion of the meeting.

NORWICH UNIVERSITY

On October 12 L. F. Bellinger, Vice-President of the Society, was a guest of the Norwich University Student Chapter, where he described some of the engineering projects with which he has been connected and showed slides depicting the work of the Corps of Engineers, U. S. Navy. There were 34 present, including five members of the faculty. The visit to Norwich was Mr. Bellinger's first since he left the university almost fifty years ago, after receiving the degree of master of science.

TEXAS TECHNOLOGICAL COLLEGE

At the first meeting of the school year, which took place on October 12, members of the Texas Technological College Student Chapter enjoyed the Society's illustrated lecture on the San Francisco–Oakland Bay Bridge. This lecture was presented by John Emmett, senior class member of the Chapter. After the lecture a business meeting was held. During this session numerous committees were appointed, and plans were made for a forthcoming visit from Field Secretary Jessup and for future inspection trips. William B. King, secretary-treasurer of the Chapter, was elected manager of the civil engineering department's part in the annual engineering show, to be held in April 1938.

UNIVERSITY OF NEBRASKA

On October 6 the first meeting of the University of Nebraska Student Chapter took place in the club rooms of the University of Nebraska Coliseum. Prof. C. E. Mickey, Faculty Adviser for the Chapter, gave an impromptu speech welcoming the new members and explaining the aims of the Society. At the conclusion of the meeting refreshments and a social hour were enjoyed.

ITEMS OF INTEREST

Engineering Events in Brief

CIVIL ENGINEERING for January

AMONG the articles scheduled for the January issue of CIVIL ENGINEERING is one by Aymar Embury II, M. Am. Soc. C.E., consulting architect of New York, N.Y., on the relation between the architect and the engineer. Starting with the somewhat uncomplimentary judgments frequently passed by persons in one of these professions on members of the other, he demonstrates the superficial nature of the underlying objections. Next he reminds us that most architects secretly admire the engineer's knowledge of "why things stand up," while few engineers "feel that any really important engineering work is complete without an architect tacked on somewhere." Finally, he points out that engineers and architects are fundamentally practicing the same art, and that their partnership should begin at the very inception of every job, so that the structural and esthetic aspects of the design may be worked out together.

Problems in structural-steel erection form the subject matter of an article by William G. Rapp, Assoc. M. Am. Soc. C.E., of the erection department of the Bethlehem Steel Company. Among the many questions which must be decided upon prior to beginning the actual field work of erection are methods of shipment and of delivery, the kinds of derricks to use, division of shipments, and the types of hoists most suitable. Foundations, blocks, cables, and slings for derricks, and equipment for their removal after completion of the work are other details to which thought must be given. Much valuable information of a practical nature is included by Mr. Rapp, who emphasizes the fact that a satisfactory erection job depends almost as much on the smooth planning of the work in advance as it does on skill in the actual execution of it.

In a third article scheduled for the January number, Francis C. Frary, director of the Aluminum Research Laboratories, New Kensington, Pa., describes the reduction of aluminum and production of aluminum alloys. Practical means for the reduction of aluminum go back only to 1886, extremely large electric currents being a practical necessity. In fact, 1,000 amperes produce only about 14 lb of pure aluminum per day. The metal thus produced is relatively soft and weak, although very ductile, and it must be either alloyed with other metals (principally copper and silicon) or cold worked, or both, to give it strength and hardness for commercial use. But the "strong" wrought alloys of aluminum are produced by still another process, that of heat-treating certain aluminum-copper alloys, adding a very small percentage of magnesium, and quenching in water. This last process dates no further back than 1906, being the work of a little-known German chemist named Alfred Wilm.

A second article sketching the highlights of engineering history, by Richard S. Kirby, M. Am. Soc. C.E., chairman of the department of engineering drawing, Yale University, will be included if space permits. This paper deals with the profession since John Smeaton (1724–1792), the first man to call himself a civil engineer. The achievements of three generations of nineteenth-century engineers are outlined in brief. The first was responsible for cast-iron arch and wrought-iron suspension bridges, canals, crushed-stone roads, and steam railroads. The second generation produced early water-supply systems, truss bridges, and paved city streets; and the third, machinery and power development, applications of steel and reinforced concrete, and sanitation.

Wise and Otherwise

DURING the current hunting season, Professor Abercrombie's dog treed a squirrel. The tree proved to be hollow, and just as the Professor arrived on the scene the squirrel reappeared at a large knot hole. The dog perceived him at the same instant and barked. Thereupon the squirrel started up the interior of the tree and one minute later looked out again at a second knot hole 75 ft higher up. The dog barked and leaped high into the air, further exciting the squirrel, which dashed down inside the trunk to the lower hole in 30 seconds. The dog was watching for him and barked menacingly. The squirrel's excitement was now so great that he made the upper hole in 15 seconds. This process was repeated, the squirrel becoming so upset that on each trip he halved his time for the preceding one. How much time elapsed before the dog saw the squirrel's head at both knot holes at the same time? (Note: This problem has a rational solution.)

November's problem was concerned with Professor Abercrombie's excursion into the kingdom of Deliria, where the speed limit is 40 mph in towns and 20 mph in the open country. Being pursued at top speed by a customs officer on whom he had a 100-ft start, the Professor entered a town laid out as shown in Fig. 1. Each car traversed 8 blocks—a total distance of $1^1/_2$ miles—at 40 mph, slowing down to 20 mph at the exit. It was required to find the distance separating them after both had emerged, also the number of different routes through the town which had been at their disposal.

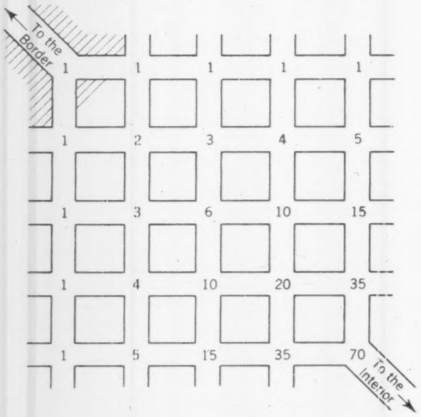


FIG. 1. PLAN OF A TYPICAL TOWN IN DELIRIA
Figures Indicate Total Number of Routes Available to Corresponding Intersections

Referring to the first question, it is evident from the wording that the motion and change of motion of both cars is identical with respect to the city limits and to all other points in their paths. Therefore, says William Trillow, author of the problem, the time interval elapsing between their passing any given point is always constant, and is equal to

$$t = \frac{100}{20}\,\frac{\text{ft hr}}{\text{miles}}$$

After emerging from the town (the velocities of the cars being now 40 miles/hr), the distance separating them, d, is equal to $40t$, or

$$d = 40\,\frac{\text{miles}}{\text{hr}} \times \frac{100}{20}\,\frac{\text{ft hr}}{\text{miles}} = 200\text{ ft}$$

The distance traversed within city limits has no bearing on the result.

Referring to Fig. 1, Mr. Trillow states that the number of ways the Professor could reach a point in any block is equal to the number of ways he could reach the preceding intersection. The number of ways he could reach any given intersection is therefore equal to the sum of the number of ways he could reach the preceding intersections. The figures in the diagram represent the number of possible ways to reach the corresponding intersections, and it is thus evident that there are 70 choices. It is interesting to note that if a town is n blocks square, the maximum possible number of routes having a total length $2n$ between two diagonally opposite corners is $\frac{\underline{|2n}.}{\underline{|n}\ \underline{|n}}$.

Water-Hammer Symposium Scheduled for December 8–9, 1937

THE SECOND symposium on water hammer, under the auspices of the committee on water hammer of the Hydraulic Division of the American Society of Mechanical Engineers, will be held in the Engineering Societies Building in New York on December 8 and 9, 1937. Many other organizations, including the American Society of Civil Engineers, are participating in the program.

Subjects to be discussed include general theory, water hammer in hydroelectric plants, and water hammer in water-works systems. One of the papers to be presented ("Pressure Due to Water Hammer in Compound and Branch Pipes," by R. W. Angus) is scheduled for the January issue of Proceedings; most of the others will be published in the *Transactions* of the American Society of Mechanical Engineers. It is expected that, following this publication, a separate volume will be prepared containing all the papers and discussions.

Recent Road Building in Mexico

By Gordon F. Rogers, Assoc. M. Am. Soc. C.E.
Union Oil Company of California, San Pedro, Calif.

Road building is one of the major items in the program of the present administration in Mexico. The federal government has a well-defined plan for developing a network of highways throughout the Republic. Some months ago, while motoring over 3,000 miles in Mexico, I had the opportunity of seeing these roads in various stages of their development.

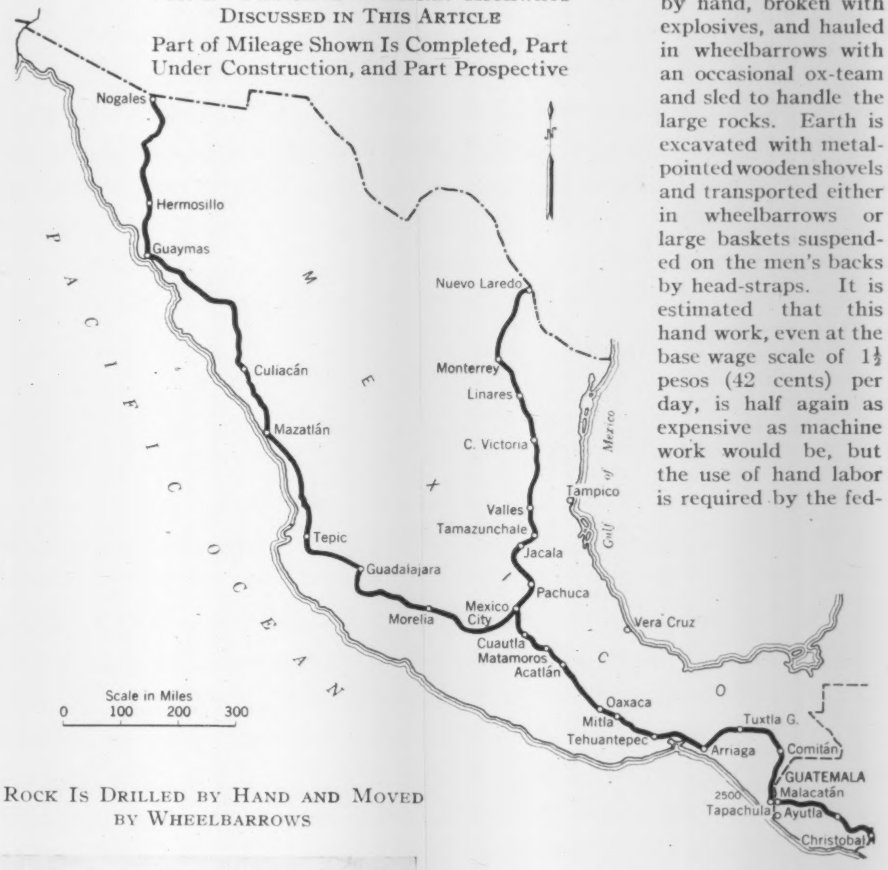
With the completion of the Laredo–Mexico City Highway (Fig. 1) and the large income resulting from heavy American tourist travel, the Mexican Government started work on the West Coast Highway. This road will be a unit in the International Pacific Highway planned to link Alaska and the Argentine. It is planned to put it in shape for all-weather travel as soon as possible, with improvement following gradually until a fine highway is achieved.

The West Coast Highway crosses the United States border at Nogales, Ariz. A gravel road extends south to Hermosillo, and construction is now under way between Hermosillo and Guaymas. From Guaymas to Mazatlan the road is impassible to any motor vehicle during the rainy season, from May until November. Even during dry weather few passenger cars attempt the trip because of protruding rocks and tree stumps. A few trucks, however, because of their greater clearance, are able to travel between the larger towns. Across the mountains between Mazatlan and Guadalajara there is only an ancient burro trail, impassible to all motor travel.

At Guadalajara a new road to Mexico City, 425 miles away, is now under construction. It passes through the lake district of the state of Michoacan. The beauty of the lake and mountain scenery, coupled with the opportunity to observe unexploited country, village, and city life, will make this road of unusual interest to travelers.

Fig. 1. Principal Mexican Highways Discussed in This Article

Part of Mileage Shown Is Completed, Part Under Construction, and Part Prospective



The contract for the Guadalajara–Mexico City construction is held by a single firm, and practically the entire road is under construction simultaneously, with 14,500 men employed. The subgrade is built by hand. Ledge rock is drilled by hand, broken with explosives, and hauled in wheelbarrows with an occasional ox-team and sled to handle the large rocks. Earth is excavated with metal-pointed wooden shovels and transported either in wheelbarrows or large baskets suspended on the men's backs by head-straps. It is estimated that this hand work, even at the base wage scale of 1½ pesos (42 cents) per day, is half again as expensive as machine work would be, but the use of hand labor is required by the federal government in an effort to decrease unemployment in this particular region.

Rock Is Drilled by Hand and Moved by Wheelbarrows

The subgrade is capped with 8 in. of crushed rock containing 25 per cent clay binder. This fill is compacted by trucks and burros. Finally a surface of four layers of crushed rock, sand, and oil, totaling 4½ in. in thickness, is applied. The finished road is 20 ft wide, broadening to 33 ft on curves, and has a 5-ft shoulder on each side. Considering present traffic requirements, the finished road will make a very good high-speed highway.

Materials for the roadway above the earth fill are produced, transported, and laid with modern machinery. Some European equipment has been used, but the contractor is now buying only equipment manufactured in the United States.

Although there are few bridges of any size along this route, there are many small bridges and culverts. In many cases the sand for the concrete and mortar is

AT WORK ON THE GUADALAJARA–MEXICO CITY HIGHWAY, IN THE MOUNTAINS OF JALISCO

brought down from mountain stream beds in saddle bags on the backs of burros.

With such methods it is surprising to see what progress is being made. Work on this 425 miles of road started in October 1935 and is scheduled to be completed before the end of 1937. The contract amounted to approximately 24 million pesos ($6^{2}/_{3}$ million dollars).

In addition to this link in the great Alaska-to-Argentina highway, the Mexican government is building tributary roads into virgin country of unsurpassed scenic beauty and interest to travelers. Such roads will open additional markets and free new land for cultivation.

South of Mexico City the government has completed the preliminary survey of the Pan American Highway to Guatemala. Of this 907-mile route, 130 miles is improved. The remaining sections, passing through mountains and tropical jungles, are the present challenge to the road builders of Mexico.

There is a shortage of engineers in Mexico to carry out the government's extensive highway, irrigation, and general building program. There is no place, however, for foreign engineers, as it is the policy of the government to conduct this work entirely without outside technical help.

The pictures of the Mexico City–Guadalajara Highway were furnished by Mr. F. Santibañez G., engineer in charge of equipment for the contractor, Cia. Mexicana de Caminos S.A.

Digest of Surveying Teachers' Conference

THAT MANY engineers make the mistake of considering surveying only as a minor engineering tool, and fail to recognize either its "intellectual content" or the opportunities it presents for career work, was stressed in round-table discussions at the conference on surveying teaching sponsored last summer by the Society for the Promotion of Engineering Education.

The conference was held at Camp Marston, summer surveying camp of Iowa State College, located on the shore of Rainy Lake near International Falls, Minn. Details of its proceedings as reported here have been supplied by Thomas C. Adams, Assoc. M. Am. Soc. C.E., associate professor of civil engineering at the University of Utah.

In considering the question of curricula in surveying, the conference recognized a distinction between the instruction that should be given civil engineering students and other engineering students, and approved a course in elementary surveying prepared by one of its committees for non-civil engineering students. This course would occupy about 6 semester credit hours and would cover rapidly the history of surveying, the importance of surveying and its relation to engineering operations, surveying work of government bureaus and specialized agencies, limitations in the practice of surveying imposed by curtailed training and experience, restrictions imposed by registration laws and professional ethics, and instruction in the use of the more common surveying instruments and in elementary surveying operations.

Other committees prepared statements of suggested content for courses in advanced surveying (primarily for civil engineering students), curves and earthwork, and photogrammetry, with recommendations for other advanced courses. The course in advanced surveying (which along with curves and earthwork is intended as an essential part of the civil engineer's training) includes the use of the more accurate instruments, mathematics of adjustment of observations and errors, field astronomy, control surveys, topographic surveys of large areas, and construction surveys. Where possible, more extended instruction was recommended in any or all of the following subjects: Hydrographic surveying, underground surveys, stream gaging, precise traversing, map projection, charting, field astronomy, least-squares adjustment, photogrammetry, and geodetic control, including the recent development of local and state-wide coordinate systems.

The course in curves and earthwork is intended to be similar to the railroad surveying course traditional in civil engineering training except that it would treat the problems of route location, curve layout, and the measurement, computation, and layout of earthwork, as elements applicable to many forms of engineering work such as highways, canals, pipe lines, transmission lines, equally as much as to railroad construction. The attitude of the committee was that such a course should be given with an engineering flavor rather than with a strictly surveying flavor. With one exception all civil engineering colleges represented at the conference now require completion of a course similar to the one outlined.

The complete course-content committee reports are to be published in a forthcoming issue of S.P.E.E.'s *Journal of Engineering Education*.

As already indicated, the conference devoted some time to discussing the professional status of surveying. It was deemed unfortunate that individuals with only elementary training in surveying and with no considerable experience consider themselves able to perform such surveying services as land surveys, and the conference adopted the policy that engineering students should be warned not to undertake, or assume responsibility for surveying work in which they are not trained and experienced. It was believed that the standing of surveying would be enhanced

MEMBERS OF THE CAMP MARSTON CONFERENCE

CAMP MARSTON, ON RAINY LAKE, MINNESOTA

by adding to the published literature on surveying, raising the educational qualifications for surveyors—particularly local practicing land surveyors and elected surveying officials of small political subdivisions—and offering special training such as extension study to those who make land surveying or other surveying their vocation and who are inadequately trained. State registration laws regulating surveying practice were considered to have done much good. Recent proposals to set up surveying as an independent branch of engineering were deplored, the preponderating belief being that surveying should remain a part of civil engineering.

Two sessions were spent in the discussion of instruments. Several members of the conference advocated adopting certain features that are commonly provided by European manufacturers, such as the three-screw leveling head, tacheometric fittings, circles reading to finer counts by optical means, and levels with bubbles that can be observed at the time the rod reading is made. Representatives of two leading instrument companies, present at these sessions, pointed out that American instruments are made to meet the demands of American surveyors, and that the makers are fully responsive to these demands and willing and able to provide any features or attachments requested. American instruments, it was brought out, are unsurpassed in accuracy or workmanship, and their superior ruggedness makes it possible for them to remain in good adjustment under adverse operating conditions and in spite of frequent abusive handling. These features are primarily demanded by the American profession.

Among the technical subjects discussed was the more widespread use of control surveys, and in particular the state-wide coordinate controls proposed by the U. S. Coast and Geodetic Survey. This new system of coordinate controls was adjudged one of the more valuable recent developments in surveying practice, and the wider use of the system was advocated, together with additional monumentation and the preparation of additional computations of coordinate position of points that are now monumented and located by accurate geodetic surveys.

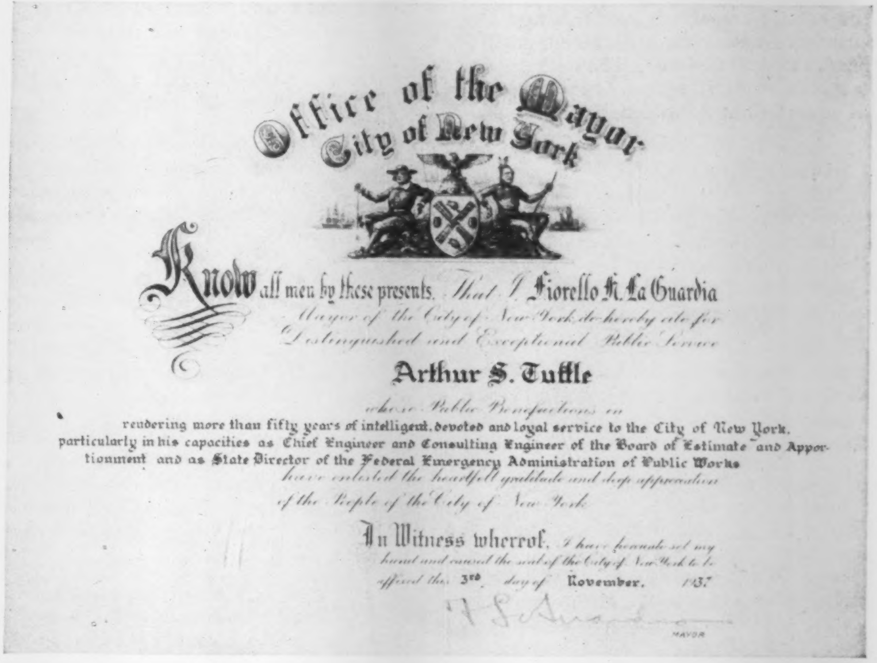
The conference also discussed what might be done to improve land surveys, and particularly the systems of land description and monumentation. The opinion was expressed that remonumentation of the U. S. Public Land surveys should be undertaken on a wide scale, and it was agreed that where the position of original monuments could be definitely established they should be replaced by more permanent monuments which should then be accurately located with respect to a precise geodetic control, preferably the Coast Survey's state-wide coordinate systems. The value of the same coordinate systems for boundary descriptions in regions where meets-and-bounds descriptions are now relied upon was stressed.

James K. Finch, M. Am. Soc. C.E., was the official representative of the Society at the conference, which included teachers of surveying from all parts of the country.

Distinguished Service Certificate Presented to Arthur S. Tuttle

ARTHUR S. TUTTLE, Past-President of the Society, has been awarded a "distinguished service certificate" of the City of New York, in recognition of "more than fifty years of intelligent, devoted, and loyal service" to the city. The presentation was made by Mayor LaGuardia on November 3, 1937, in a ceremony at the city hall, on the occasion of Mr. Tuttle's retirement from the post of state director of the Federal Emergency Administration of Public Works. Special reference was made in the citation to his work in that capacity and as chief engineer and consulting engineer of the Board of Estimate and Apportionment.

In presenting the certificate, the Mayor pointed out that this is an age "where special training and technical ability are necessary in public office." In the last three and a half years, he said, Mr. Tuttle had passed upon every application for funds for schools, bridges, sewage-disposal plants and all other improvements that had cleared through PWA, and "his vast experience and understanding did much to help in cutting red tape and expediting New York's applications."



Office of the Mayor
City of New York

Know all men by these presents, That I, Fiorello H. La Guardia
Mayor of the City of New York do hereby cite for
Distinguished and Exceptional Public Service

Arthur S. Tuttle

whose Public Benefactions in
rendering more than fifty years of intelligent, devoted and loyal service to the City of New York, particularly in his capacities as Chief Engineer and Consulting Engineer of the Board of Estimate and Apportionment and as State Director of the Federal Emergency Administration of Public Works
have enlisted the heartfelt gratitude and deep appreciation
of the People of the City of New York

In Witness whereof, I have hereunto set my hand and caused the seal of the City of New York to be affixed this 3rd day of November, 1937

MAYOR

Brief Notes from Here and There

THE American Society of Mechanical Engineers announces the election on September 28, 1937, of the following new officers for 1938, who will assume office on December 10, 1937: For president, H. N. Davis, president of the Stevens Institute of Technology; for vice-presidents, F. O. Hoagland, Hartford, Conn.; B. M. Brigman, Louisville, Ky.; Harte Cooke, Auburn, N.Y.; W. H. McBryde, San Francisco, Calif.; L. W. Wallace, Chicago, Ill.; for managers, Carl L. Bausch, Rochester, N.Y.; S. B. Earle, Clemson College, S.C.; and F. H. Prouty, Denver, Colo.

* * * *

AT THE annual meeting of the American Association for the Advancement of Science, to be held in Indianapolis, Ind., the week of December 27, 1937, the Association's Section (M) on Engineering will participate with the Indiana Engineering Council in a series of conferences on the social impacts of science and technology. In connection with the meeting, an annual science exhibition will be held December 27–30, 1937, at which space will be furnished free of charge to both research and commercial exhibitors. Data on cosmic-ray measurements and photographs of the solar corona will be included among the exhibits.

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SOMEWHAT belatedly word has reached Society Headquarters of another member honored during the past commencement season. Philip Curtis Nash, M. Am. Soc. C.E., president of the University of Toledo, was awarded the honorary degree of doctor of engineering by the Case School of Applied Science. More recently, Hardy Cross, M. Am. Soc. C.E., was awarded the honorary degree of doctor of engineering by Lehigh University, at its 59th founder's day exercises, held in Bethlehem, Pa., on October 6. This brings the number of degrees awarded in 1937 to 14, a considerable increase over those given in previous years. Of course such honors may have been awarded to other members of whom the Society has not yet heard.

NEWS OF ENGINEERS

Personal Items About Society Members

Paul H. Underwood, formerly professor of surveying in the school of civil engineering, Cornell University, has been made director of the school of civil engineering, succeeding S. C. Hollister.

John A. Allis, previously an assistant engineer in the U. S. Geological Survey at Stillwater, Okla., has accepted a position as associate engineer in the Soil Conservation Service at Lincoln, Nebr.

John W. McReynolds has resigned from the Missouri State Highway Department to enter the engineering department of the Chicago, Milwaukee, St. Paul, and Pacific Railroad Company, with headquarters in Aberdeen, S.Dak.

Harold B. Gotaas has accepted a position as assistant professor of sanitary engineering in the school of public health at the University of North Carolina. He was formerly located at Vermillion, S.Dak., where he was assistant professor of applied science in the University of South Dakota and city engineer of Vermillion.

Arthur G. Olmsted, until recently field engineer for the WPA in Ohio, is now employed as construction engineer in the engineering department of the Pittsburgh Plate Glass Company at Barberton, Ohio.

Frederick E. Turneaure has retired as head of the college of engineering at the University of Wisconsin after forty-five years of service. In 1892 he was first appointed to the faculty of the college as professor of bridge and hydraulic engineering, and he was dean for over thirty-three years. Dean Turneaure was elected an Honorary Member of the Society in 1933, and in July 1937 he was awarded the tenth Lamme Medal of the Society for the Promotion of Engineering Education.

Eldon F. Matteson, formerly in the engineering department of the Concrete Steel Company, in New York City, has become connected with the Turner Construction Company, at Wilmington, Del.

James G. Moore has entered the employ of the Aetna Iron and Steel Company, at Jacksonville, Fla. Previously he was field engineer of the WPA for Florida.

Morris B. Uhrich, until recently in the U. S. Engineer Office at Waterbury, Vt., has secured a position in the engineering department of the Link-Belt Company in Chicago, Ill.

Walter M. Enger, junior engineer in the U. S. Bureau of Reclamation, has been transferred from the Denver office of this organization to Parker Dam.

R. M. Sydney Harris is now Idaho State Engineer for the Agricultural Adjustment Administration, with headquarters at Moscow, Idaho. He was formerly chief engineer of WPA District 1 at Boise, Idaho.

David C. Filley has accepted a position in the civil engineering department of the Humble Oil and Refining Company at Tyler, Tex. He is no longer connected with the Petty Geophysical Company, of San Antonio, Tex.

Arthur Milnamow, formerly an engineer for the Delaware River Bridge Commission, at Collingswood, N.J., is now a designer for Wood and Kirkpatrick, consulting engineers of Philadelphia, Pa.

Frank A. Banks, construction engineer for the U. S. Bureau of Reclamation at Coulee Dam, Wash., has been designated by the Secretary of the Interior to represent him on an advisory board composed of representatives designated by the Secretary of War, the Federal Power Commission, and the Secretary of Agriculture to act in consultation with the administrator in charge of the sale and distribution of power from Bonneville Dam.

A. D. Schmid is now in the engineering department of the Mosher Steel Company, in Dallas, Tex. He was formerly resident engineer in the Texas State Highway Department, at Cisco, Tex.

Abraham Verduin has become resident engineer for the Tilt-Hargan Company, engineers and contractors of New York City, on the construction of a new pier for the Clyde-Mallory Lines. His headquarters are at Charleston, S.C.

F. G. Gramatky, until recently associate engineer in the U. S. Engineer Department, Los Angeles District, has taken a position as contracting engineer with the Consolidated Steel Corporation, Ltd., Los Angeles, Calif.

Fred Woolley has resigned as right-of-way agent for the Bureau of Highways at Boise, Idaho, to accept a position in the U. S. Engineer Office at Fort Peck, Mont.

Gilberto M. Font is now with Salvador Quinones, contracting engineer of Aguadilla, Puerto Rico, in the capacity of superintendent of construction of the Charity District Hospital of Aguadilla.

Reeves J. Newsom has, with James C. Harding, established a private consulting practice at 500 Fifth Avenue, New York City, where he will specialize in waterworks and sewerage problems. Mr. Newsom recently resigned as president of the Community Water Service Company, of New York City, while Mr. Harding previously maintained a sanitary engineering practice in the same city.

William M. Branch, formerly with the Engineering Data Division of the Tennessee Valley Authority, has entered the employ of the Combustion Engineering Company, Inc., of New York City.

Adolph J. Ackerman, for the past four years construction plant engineer for the Tennessee Valley Authority, has been appointed development engineer for the engineering works division and the contracting division of the Dravo Corporation at Pittsburgh, Pa.

Chien-Hsi Liu is now associate engineer and chief of the designing division of the engineering department of the Nanking-Kiangsi Railway, with headquarters at Suancheng. He was formerly assistant engineer on the Canton-Hankow Railroad.

Arthur Ellwood, until recently assistant engineer to the borough president of Brooklyn, N.Y., is now employed as assistant engineer in the U. S. Engineer Office at Binghamton, N.Y.

Patric W. Neil, previously structural detailer for the J. B. Beaird Corporation, of Shreveport, La., is now employed in a similar capacity by the Orange Car and Steel Company, of Orange, Tex.

W. R. Holway and H. C. Neuffer, of the firm, Holway and Neuffer, consulting engineers of Tulsa, Okla., have been appointed project engineers on the Grand River Dam project, to be constructed in the northeastern part of Oklahoma, near Pensacola.

J. A. C. Bogart is now city manager of Fernandina, Fla.

Paul Hall, formerly office engineer for the Austin Bridge Company at Galveston, Tex., has become a junior engineer for the Humble Oil and Refining Company, of Crowley, La.

S. C. Hollister was recently appointed dean of the college of engineering at Cornell University. Professor Hollister, who has been acting dean since the death of Dean Herman Diederichs last summer, was formerly associate dean of the college and, at the same time, director of the school of civil engineering. Professor Hollister went to Cornell in 1934 from Purdue University, where he had been professor of structural engineering.

S. C. Hollister

Wilbur M. Wilson, research professor of structural engineering at the University of Illinois, has been awarded the Octave Chanute Medal by the Western Society of Engineers for the years 1935–1937. The award is made for Professor Wilson's paper on "The Present Status of Structural Welding."

H. R. F. Helland has been named general manager and consulting engineer for the Willacy County Irrigation District, with headquarters at Harlingen, Tex.

John Latenser, Jr., has resigned as state engineer of the PWA at Omaha, Nebr., to establish a private practice as an architect and construction engineer.

F. P. Shearwood has resigned as chief engineer of the Dominion Bridge Company, Ltd., of Canada to accept an appointment as consulting engineer for the company. Mr. Shearwood has been with this organization for fifty years.

Howard W. Tillapaugh is now safety engineer for the Royal-Liverpool Insurance Groups, with headquarters in Detroit, Mich. He was formerly research engineer for the Highway Research Board of the National Research Council at East Lansing, Mich.

George M. March, previously consultant for the League of Kansas Municipalities at Lawrence, Kans., has become city manager of El Reno, Okla.

Edward Silberman recently entered the employ of the Bureau of Air Commerce in the capacity of junior civil engineer. His headquarters are in Washington, D.C. Mr. Silberman was formerly engineering aide in the general planning division of the Tennessee Valley Authority at Knoxville, Tenn.

Ben Moreell, commander, C.E.C., U. S. Navy, has been appointed chief of the Bureau of Yards and Docks, Washington, D.C., with the rank of rear admiral. He will assume his new duties on December 1. At the time of his appointment Commander Moreell was head of the Department of Public Works, Pearl Harbor Navy Yard, Hawaii.

O. J. Schieber, who is with the Metropolitan Water District of Southern California, is now serving as division engineer on the construction of the Colorado River Aqueduct, one of the projects of the Metropolitan Water District.

W. L. Chadwick has resigned as senior engineer for the Metropolitan Water District of Southern California to accept a position with the Southern California Edison Company, in Los Angeles, Calif.

E. N. Gustafson has been promoted from the position of highway engineer for the Portland Cement Association to that of assistant district engineer for the same organization. His headquarters are in Austin, Tex.

James A. Thompson, until recently engineer and accountant for the South St. Louis Slate and Tile Roofing Company, St. Louis, Mo., is now employed as cashier with the Twin City Lumber and Shingle Company at St. Paul, Minn.

Julian Hinds and **Franklin Thomas** have been included on an advisory committee of prominent engineers recently appointed by Governor Merriam, of California, to make studies and recommendations regarding the water problems of the state of California.

John Stewart is now consulting engineer for the Cia Exploradora de Durango, Mexico, a mining organization. His headquarters are at Parral, Chihuahua, Mexico.

Leslie J. Reardon, formerly connected with the Public Works Administration at Cincinnati, Ohio, is now chief engineer of the Brick Manufacturers' Association, in Cleveland, Ohio.

Percy A. Seibert, general representative of the Braden Copper Company, of Santiago, Chile, was recently honored with the rank of Knight Commander of the Order of Merit for his long and outstanding services to the country.

Louis C. Hill has been awarded honorary membership in the Scientific Institute for Studies of the Communications and Means of Transportation of Paris.

Edward M. Noon is now an engineer for the Martin Engineering Company at Maracaibo, Venezuela. He was formerly resident engineer for Gregory and Bernard at Orange, Tex.

George R. Brown, vice-president in charge of Brown and Root, Inc., of Houston, Tex., has been appointed a member of the Texas State Board of Engineer Examiners for a four-year term.

Roy T. Jennings has taken a position as instructor in civil engineering at North Dakota State College, Fargo, N.Dak.

Paul A. Jones, who is in the U. S. Bureau of Reclamation, has been transferred from Yuma, Ariz., to Glendive, Mont., where he is construction engineer on the Glendive unit of the Buffalo Rapids Project.

William Enkeboll, formerly mechanical draftsman for the Pacific Car and Foundry Company, of Renton, Wash., is now an instructor in general engineering at the University of Washington.

DECEASED

Nicholas Antony Alexieff (Assoc. M. '25) died on September 2, 1937. He was born at Yekaterinoslav, Russia, on December 18, 1891, and graduated from the Imperial Institute of Petrograd, Russia, in 1917. Mr. Alexieff's early career included experience in the design and construction of a railroad terminal in Moscow and work as a highway and designing engineer in Yugoslavia. Coming to the United States in 1923, he was employed by the Thompson and Binger Company and the Electric Bond and Share Company, both of New York City. From 1935 to 1932 he was with the Concrete Steel Company in charge of the design and estimating of different types of reinforced concrete structures. In the latter year he became squad leader of an Emergency Relief Bureau project under the auspices of the New York City Department of Public Works, where he remained until 1935.

Charles Rollin Allen (Assoc. M. '11) consulting engineer of Saratoga Springs, N.Y., died at his home there on September 29, 1937. Mr. Allen, who was 64, was born at Mechanicville, N.Y. In 1899, following his graduation from Tufts College, he was employed by the Metropolitan Sewer Commission of Boston, where he remained until 1902. From 1903 until 1905 he was city engineer of Barre, Vt., in full charge of paving and other work. In 1906 he became connected with the New York State Highway Department, where he remained for many years before entering private practice.

Charles Robert Bettes (M. '09) of Far Rockaway, N.Y., died on October 29, 1937. Mr. Bettes was born at Youngsville, Pa., in 1863. From 1881 to 1893 he was an assistant in the office of Charles B. Brush in charge of surveys and improvements, and from 1894 to 1897 he was resident engineer on the design and enlargement of plant for the Queens County (New York) Water Company. In the latter year he became chief engineer and manager of the company, retaining this position for over twenty years. Later Mr. Bettes was general manager of the Long Island Water Corporation, with headquarters at Far Rockaway. He retired in 1934.

William Herbert Cushman (M. '06) consulting hydraulic engineer of Watertown, N.Y., was killed in an automobile accident on October 10, 1937. Mr. Cushman, who was 68, was born at Duxbury, Mass. His early career included experience in the design and construction of power plants—notably, those at Massena, N.Y.; Morgan Falls, Ga.; Huntingdon, Pa.; Estacada, Ore.; and Hales Bar, Tenn. From 1910 to 1913 he had a consulting practice; from 1915 to 1920 he was president of the Hydraulic Construction Company; from 1921 to 1924, consulting engineer of Watertown, N.Y.; and from 1926 to 1927, consulting engineer of Newton Falls, N.Y. In 1927 he established his consulting practice, specializing in water power appraisals, and from 1933 until his death he also held engineering posts, successively, with the CWA, the TERA, and the WPA.

Edgar Sutton Dorr (M. '95) died in Dorchester, Mass., on October 5, 1937, at the age of 83. Mr. Dorr was born in Boston, Mass., and educated at the Massachusetts Institute of Technology. Following his graduation in 1875, he entered the sewer and water division of the Boston Public Works Department, where he remained until his retirement. During his forty-four years of service in this department, he was promoted through the various grades from rodman to that of chief engineer in direct charge of the department.

Charles William Hazelton (M. '91) died at his home at Turners Falls, Mass., on September 29, 1937, at the age of 89. Mr. Hazelton was born in Plymouth, N.H. When he was 20 he went to Turners Falls, which was virtually a wilderness, and surveyed the town. In 1870 he became connected with B. N. Farren, for whom he later served on the construction of the Hoosac Tunnel. He later returned to Turners Falls as a contractor, his firm building many of the important structures in the community. Mr. Hazelton was also instrumental in the development of the Turners Falls Company, serving as assistant engineer in the construction of the dam and canal. Later he was treasurer and clerk of the company, remaining in that position until 1912.

Harry Monmouth Herbert (M. '98) retired consulting engineer of Seaside Heights, N.J., died there on October 6, 1937, at the age of 81. Upon his graduation from Rutgers University in 1878, he entered railroad work, finally becoming chief engineer for the Delaware, Lackawanna, and Western Railroad. Later he served as chief engineer of Camden, Trenton, and other New Jersey cities and, for a time, he was New Jersey State Sewerage Commissioner. He prepared the plans for and was the engineer in charge of the sewer system of Seaside Heights. For many years prior to his recent retirement, Mr. Herbert maintained a consulting practice in Seaside Heights.

William Edward Johnson (Assoc. M. '01) of West Hartford, Conn., died in June 1937. From 1890 to 1895 Mr. Johnson was chief assistant of the Hartford (Conn.) Water Works. In 1895 he became connected with the Hartford Water Commission as engineer, chief engineer, and division engineer of the reservoir division, successively. He held the latter position for many years, retiring in 1936.

Francis Howe Kendall (M. '26) county engineer of Middlesex County, Massachusetts, died at Montague City, Mass. on October 7, 1937, at the age of 68. Mr. Kendall was born at Belmont, Mass., and graduated from the Massachusetts Institute of Technology in 1890. In 1892, after a period as assistant instructor in civil engineering at Massachusetts Institute of Technology and as civil engineering assistant for the Cleveland, Cincinnati, Chicago and St. Louis Railway, he became principal assistant to the county engineer of Middlesex County. Since 1894 he had been county engineer.

Charles William Henry Nessler (Assoc. M. '36) associate engineer for the U. S. Geological Survey at Sacramento, Calif., died in San Francisco on October 7, 1937. Mr. Nessler, who was 46, was born at Mountain View, Calif. Except for two years of war service, he spent his entire career with the U. S. Geological Survey. Beginning in 1912 as a rodman, he passed through the various grades of promotion, and during the past ten years he had been engaged in mapping Los Angeles County. In 1917 and 1918 he served with the 29th Engineers in France, contracting while there the illness that later proved fatal.

Thomas Sarsfield O'Connell (M. '30) Arizona State Highway Engineer, of Phoenix, Ariz., died on November 4, 1937. Mr. O'Connell was born in San Francisco, Calif., on July 14, 1888, and was educated at the University of Arizona. From 1909 until 1913 he was with the Southern Pacific Company. In the latter year he became connected with the Arizona State Highway Department, where his career was unbroken except during the World War when he served as a first lieutenant with the A. E. F. During Mr. O'Connell's long connection with the Highway Department he was, successively, levelman, transitman, assistant engineer, location engineer, district engineer, and finally, in 1931, state engineer and executive head of the department.

Robert Vance Orbison (M. '22) of South Pasadena, Calif., died on October 20, 1937. Mr. Orbison, who was 55, was born at Sidney, Ohio. His early experience included engineering positions with the Utah Sugar Company, the Occidental Copper Company, and the Stone and Webster Company. From 1913 to 1914 he was deputy city engineer for the city of Pasadena, Calif.; from 1914 to 1920, city engineer of Pasadena; from 1920 to 1925, city manager and city engineer of South Pasadena; and from 1925 to 1931, city manager of Pasadena. With the passage of the Federal Housing Act, Mr. Orbison went to Washington in the capacity of Federal Housing Engineer. In 1935 he returned to South Pasadena to take a position with the California state government in the Veterans' Bureau.

John Brognard Shinn (M. '24) a civil engineer of Washington, D.C., died in that city on September 27, 1937 at the age of 60. Mr. Shinn was born in Raleigh, N.C., and educated at Columbian University (now George Washington University). From 1901 to 1904 and from 1906 to 1908 he was in the Surveyor's Office of the District of Columbia, and from 1908 to 1917 he was assistant surveyor for the District of Columbia. He resigned from the latter position to enter the army. In 1922 Mr. Shinn became engineer in charge of city planning and zoning for the Richmond (Va.) Department of Public Works, and later he served as vice-president of Allen J. Saville, Inc., of Richmond. He opened his consulting office in Washington in 1933.

Sydney George Slusher (Assoc. M. '23) of San Francisco, Calif., died on August 21, 1937. Mr. Slusher was born at Chino, Calif., in 1894, and graduated from the University of California in 1918. His career included a variety of engineering experience. He served as resident engineer on the construction of sewers at Okmulgee, Okla., and Sayreville, N.J.; as draftsman on numerous bridges and structures; and as transitman and chief of party on several projects. In 1931 and 1932 Mr. Slusher was welding inspector on the construction of the Hetch-Hetchy pipe line; in 1933 he was concrete inspector on the construction of the Golden Gate Bridge; and in 1935 and 1936 he was connected with the U. S. Forest Service.

The Society welcomes additional biographical material to supplement these brief notes and to be available for use in the official memoirs for "Transactions."

George Reed Wadsworth (M. '09) assistant commissioner—superintendent of prison industries, New York State Department of Correction, New York City, died on November 1, 1937. Mr. Wadsworth was born at Keene, N.H., on August 22, 1875, and graduated from Massachusetts Institute of Technology in 1898. His early career included experience with the New York Central Railroad and as consulting engineer to the Metropolitan Improvement Commission, Boston. After service in the aviation section of the U. S. Army during the war, he became vice-president of the United Aircraft Engineering Corporation, New York City, and later was vice-president and general manager of the Conlon Corporation, Chicago. For nine years before his death he was assistant commissioner of the New York State Department of Correction.

James Goold Warren (M. '14) retired colonel, Corps of Engineers, U. S. Army, of Buffalo, N.Y., died on November 2, 1937, at the age of 79. He was born in Buffalo and graduated from the U. S. Military Academy in 1881 and from the U. S. Engineer School in 1884. Upon his graduation, he was commissioned second lieutenant, Corps of Engineers, U. S. Army. He was gradually promoted through the various military grades, becoming colonel in 1912. Colonel Warren's army career included experience as secretary of the Mississippi River Commission; as engineer in charge of river and harbor work for the Louisville District, the Milwaukee District, and the Cincinnati District; and as division engineer supervising all river and harbor improvements on the Great Lakes.

Robert Joseph Henderson Worcester (M. '25) personnel director of the American Bemberg Corporation and of the North American Rayon Corporation, Elizabethton, Tenn., died on September 27, 1937. Mr. Worcester was born in Boston, Mass., on December 8, 1882. In 1905 he became connected with Westinghouse, Church, Kerr and Company, where he remained until 1913. From 1913 to 1917 and from 1919 to 1920 he was engineer and superintendent of Concord, Mass. He was then employed for a number of years as resident engineer for Lockwood, Greene and Company on the construction of cotton mill and steam power plants in the South. Later he was personnel director of the American Bemberg-Glanzstoff Corporations, which in 1935 was succeeded by the American Bemberg Corporation and the North American Rayon Corporation. During the war Mr. Worcester served as a first lieutenant with the U. S. Army in France.

Changes in Membership Grades

Additions, Transfers, Reinstatements, and Resignations

From October 10 to November 9, 1937, Inclusive

ADDITIONS TO MEMBERSHIP

ABELL, JULIAN DAVID (Jun. '37), Corozal, Canal Zone.

ADAMS, FREDERICK CARL, JR. (Jun. '37), 1233 Broadway, Brooklyn, N.Y.

ALEN, RUPERT OLE (Jun. '37), Care, Div. of Highways, Dist. 1, Eureka, Calif.

ALLEN, JOHN WILLIAM (Jun. '37), 1098 Mt. Vernon Ave., Akron, Ohio.

ALT, GLENN LESLIE (Assoc. M. '37), Asst. Prof., Structural Eng., Univ. of Michigan (Res., 918 Sybil St.), Ann Arbor, Mich.

AMNEUS, THOMAS AXEL (Jun. '37), 5343 Boyd Ave., Oakland, Calif.

ANDERSON, EDWARD WALTER (Jun. '37), 674 East 235th St., New York, N.Y.

BARNES, BERTRAM SOULES (Assoc. M. '37), Supervisor of Hydrologic Work, U. S. Weather Bureau, Weather Bureau Office, Davenport, Iowa.

BARR, JAMES CHESTER (Assoc. M. '37), Engr. Examiner, PWA, Los Angeles (Res., 3404 Flower St., Huntington Park), Calif.

BEEBE, JOHN RICHARD (Jun. '37), Draftsman, Truscon Steel Co. (Res., 1548 Florencedale Ave.), Youngstown, Ohio.

BENEDICT, GEORGE BERNARD (Assoc. M. '37), Departmental Engr., Tide Water Associated Oil Co., New York, N.Y. (Res., 22 Valley View Terrace, Moorestown, N.J.)

BERG, JOHN, JR. (Jun. '37), Asst. Engr., State Dept. of Highways (Res., 408 Second St.), Bismarck, N.Dak.

BERGER, HERMAN WILLIAM, JR. (Jun. '37), 4100 Dorchester Rd., Baltimore, Md.

BLACK, ROBERT SIGMAN, JR. (Jun. '37), Clifton, Ariz.

BOEHLKE, JOHN HENRY (Jun. '37), Plainview, Minn.

BONUCCHI, VICTOR PAUL (Jun. '37), Box 53, Standard, Ill.

BRITZ, HAROLD MICHAEL (Assoc. M. '37), Senior Structural Draftsman and Junior Civ. Engr., Office of City Engr. (Res., 5352 Helen Ave.), Detroit, Mich.

BROSIO, ALFRED LOUIS (Jun. '37), 1458 Union St., San Francisco, Calif.

BYINGTON, ROBERT RICHARD (Jun. '37), 4520 North Hermitage Ave., Chicago, Ill.

CARR, JAMES HENRY, JR. (Jun. '37), Structural Engr., Timber Eng. Co. (Res., 1621 New Hampshire Ave., N.W.), Washington, D.C.

CHARLTON, KENNETH JAMES (Jun. '37), 3055 Shattuck, Berkeley, Calif.

CLARKE, JOHN CLINTON (Jun. '37), Asst. San. Engr., State Board of Health (Res., 519 Dexter Ave.), Montgomery, Ala.

CRANDALL, LEE WALTER (Jun. '37), Civ. Eng. Dept., Univ. of Colorado, Boulder, Colo.

CRANE, CLAYTON O'DELL (Jun. '37), Junior Engr., U. S. Bureau of Reclamation, Room 428 Custom House, Denver, Colo.

CRAWFORD, LEONARD KENNETH (Jun. '37), Junior Engr., Wood, Walraven & Tilly, 322½ South 6th St., Springfield, Ill.

CRIPPEN, GLENN EDWARD (Jun. '37), Junior Engr., U. S. Bureau of Reclamation, 3429 St. Paul St., Denver, Colo.

CUBBISON, GERALD LLOYD (Jun. '37), 143 McCroskey Ave., Knoxville, Tenn.

DAVIDSON, JOHN KING (Jun. '37), Eagle Lake, Tex.

DECHAENE, ROLAND JULES (Jun. '37), 611 Newark Ave., Elizabeth, N.J.

DODDS, ROBERT HUNGERFORD (Jun. '37), 7 Gramatan Gardens, Bronxville, N.Y.

DOOLITTLE, ALBERT WHITING, JR. (Jun. '37), 826 Thorne St., Sewickley, Pa.

DRACHMAN, ALLEN OGDEN RICE (Jun. '37), Care, U. S. Gypsum Co., Midland, Calif.

DRECHSLER, MEYER (Assoc. M. '37), Res. Engr. Insp., PWA, 55 West Broadway, Long Beach, N.Y.

DRISKELL, JOHN JOSEPH (Jun. '37), With Eng. Dept., Am. Bridge Co. (Res., 334 Glenwood Drive), Ambridge, Pa.

ELGIN, ROBERT LEWIS (Jun. '37), Student Engr., Phillips Petroleum Co. (Res., 506 North Grand), Okmulgee, Okla.

EPPERSON, ELLSWORTH JAMES (Assoc. M. '37), Senior Civ. Engr., County of Los Angeles, County Surveyor Dept., Storm Drain Div. (Res., 3790 South Harvard Boulevard), Los Angeles, Calif.

ERICKSON, LINNE FELIX (Jun. '37), Asst. Materials Testing Engr., Materials Laboratory, Univ. of Idaho and Bureau of Highways, Box 403, University Station, Moscow, Idaho.

FAUSTMAN, DANIEL JACKSON (Jun. '37), 73 Perkins Hall, Harvard Univ., Cambridge, Mass.

FISHER, CHARLES ROSWELL (Assoc. M. '37), Technical Advisor and Trainor, TVA Field Parties, U. S. Geological Survey, 410 Federal Bldg., Chattanooga, Tenn.

FITCH, KENNETH STUART (Jun. '37), With Bureau of Reclamation, Friant Div., Friant, Calif.

FLETCHER, JOSEPH FRANCIS (Jun. '37), 8 California St., Xenia, Ohio.

FRANKLIN, RICHARD JACCOUD (Jun. '37), 321 East Cherry St., Watseka, Ill.

FRIEDMAN, SAM STANLEY (Jun. '37), Asst. Engr., New York City Park Dept., Topographical Div. (Res., 792 Linden Boulevard), Brooklyn, N.Y.

FUCIK, EDWARD MONTFORD (Jun. '37), 2767 South Deere Park Drive, Highland Park, Ill.

GAIN, EDWARD JACOB ARTHUR (Assoc. M. '37), Civ. Engr., Board of Public Service, Sewers and Paving Section, City of St. Louis (Res., 622 Eastgate Ave.), St. Louis, Mo.

GATES, ROBERT HOWARD (Jun. '37), R.R.2, New Lebanon, Ohio.

GLASS, SHERMAN (Jun. '37), 264 Ryerson St. Brooklyn, N.Y.

HASTINGS, ROBERT FRANK (Jun. '37), 161 Highland Ave., Highland Park, Mich.

HEIL, BOYCE FERDINAND (Jun. '37), Field Engr., Shell Petroleum Corporation, Houston Refinery, Houston, Tex.

HOMMON, JAMES BRITTON (Jun. '37), 6407 Regent St., Oakland, Calif.

HOOKE, ALBERT CHARLES (Jun. '37), 510 North Robinson St., Baltimore, Md.

HOROWITZ, FERMOND CECIL (Jun. '37), 841 North Croft Ave., Los Angeles, Calif.

JOHNSON, FRED ATKINS (Jun. '37), 17 Alsace Ave., Buffalo, N.Y.

JOHNSON, SAMUEL ARVID, JR. (Jun. '37), Staff House, Grand Falls, Newfoundland.

JOHNSTON, WILLIAM CARLETON (Assoc. M. '37), Chf. Draftsman, State Highway Dept. (Res., 722 Battery), Little Rock, Ark.

JOSLYN, RAYMOND JOSEPH (Jun. '37), Asst. Field Engr., United Light & Power Eng. and Const. Co. (Res., 734 Brady St.), Davenport, Iowa.

KACHORSKY, MICHAEL SERGE (Jun. '37), Box 283, Manville, N.J.

KEENAN, WILLIAM HENRY, JR. (Jun. '37), 910 Park Ave., Indianapolis, Ind.

KELLER, LYNDON MAYNARD (Jun. '37), 14 Cortland Pl., Albany, N.Y.

KEVAN, GLENN HERMAN (Jun. '37), Asst. Designer, State Highway Dept., 1338 West Euclid St., Topeka, Kans.

KLINGEL, THOMAS RALPH (Jun. '37), 310 West Annapolis St., St. Paul, Minn.

LEFEBER, FRANCIS FREDERICK (Jun. '37), 34-34 Seventy-third St., Jackson Heights, N.Y.

LYLE, LAWRENCE HENRY (Jun. '37), Asst. Superv. Surv., WPA, Navy Pier (Res., 4056 North Richmond St.), Chicago, Ill.

MCALPIN, GEORGE WASHINGTON (M. '37), Highway Planning Engr., State Road Comm. (Res., 1584 Virginia St.), Charleston, W.Va.

MCDOWELL, LESLIE PAUL (Assoc. M. '37), Office Engr., PWA, Box 509, Pittsburg, Kans.

MCKEE, ROBERT WILSON (Jun. '37), 97 Ontario St., Corning, N.Y.

MAEVIS, ALFRED CORNELIUS (Jun. '37), 89-34 One hundred and thirty-fifth St., Richmond Hill, N.Y.

MALONEY, THOMAS FRANCIS (Jun. '37), 153 Bedford Ave., Brooklyn, N.Y.

MARR, GEORGE JOHNATHON (Jun. '37), 1103 Keeler Ave., Berkeley, Calif.

MASCHMEYER, WILLIAM LOUIS (Jun. '37), Junior Engr., U. S. Engrs., Vicksburg Dist., Sardis, Miss.

MAXWELL, GEORGE HENRY, JR. (Jun. '37), Lexington, Tenn.

TOTAL MEMBERSHIP AS OF NOVEMBER 9, 1937

Members	5,616
Associate Members	6,104
Corporate Members	11,720
Honorary Members	26
Juniors	3,476
Affiliates	79
Fellows	1
Total	15,302

Merryman, Harold Woodrow (Jun. '37), 3 Sacramento St., Cambridge, Mass.

Morgan, John Rollin (Jun. '37), 1310 Eleventh St., Modesto, Calif.

Morris, George Augustus (Assoc. M. '37), Engr., U. S. Engr. Office, Vicksburg, Miss.

Morrison, Herbert John (Jun. '37), 620 West Pensacola St., Tallahassee, Fla.

Nagler, Maurice (Jun. '37), 257 East 2d St., New York, N.Y.

Nelson, John Emil (Jun. '37), 606 Thirteenth St., Galveston, Tex.

Nesto, Raymond Rocco (Jun. '37), 388 Highland Ave., Newark, N.J.

Nussbaumer, Fred William (Jun. '37), Tatum, N.Mex.

O'Brien, Jack Charles (Jun. '37), 664 Bowen St., Dayton, Ohio.

Okun, Daniel Alexander (Jun. '37), California Inst. of Technology, Pasadena, Calif.

Peterson, DelRoy Carl Roger (Jun. '37), 3511 Colfax Ave., North, Minneapolis, Minn.

Prince, Elmer Woodward (M. '37), City Mgr. (Res., 310 Wilson Ave.), Morgantown, W.Va.

Puterbaugh, Jack Dudley (Jun. '37), Centerville, Ohio.

Rahl, Marvin Edward (Assoc. M. '37), Asst. Engr., Borough of Manhattan (Res., 545 West 111th St., Apartment 9-A), New York, N.Y.

Renner, Walter Adolf (Jun. '37), 214 M.T.L., Univ. of Illinois, Urbana, Ill.

Richmond, Wallace Parrish (Jun. '37), Kyle, Tex.

Ridenour, Gerald Marcellus (Assoc. M. '37), Asst. Prof., Dept. of Water Supplies and Sewage Disposal, Rutgers Univ.; Research Engr., Dept. of Water and Sewage Research, Agri. Experiment Station (Res., Colonial Gardens), New Brunswick, N.J.

Rizzi, Anthony Vincent (Jun. '37), 170-03 Ninetieth Ave., Jamaica, N.Y.

Robbins, Edwin Guy (Jun. '37), Care, Portland Cement Assoc., 33 West Grand Ave., Chicago, Ill.

Robley, Grant (Jun. '37), Instr., Civ. Eng. Dept., Oregon State Coll. (Res., 131 North 23d St.), Corvallis, Ore.

Roller, Charles Elmer, Jr. (Jun. '37), 722 East Phil-Ellena St., Philadelphia, Pa.

Savidge, Paul Sheppard (M. '37), Vice-Pres., Industrial Engrs. & Contrs., Inc. (Res., 502 North D St.), Tacoma, Wash.

Saxton, Ren George (M. '37), Prof. and Head of Dept. of Civ. Eng., Oklahoma Agri. and Mech. Coll. (Res., 1215 College Ave.), Stillwater, Okla.

Schaffel, Francis Lewis (Jun. '37), 2831 Dwight Ave., Dormont, Pittsburgh, Pa.

Schwartz, Moe Isaac (Jun. '37), 443 Hendrix St., Brooklyn, N.Y.

Scott, James Morrison (Jun. '37), 621 Beechwood Ave., Carnegie, Pa.

Servet, Abdurrahim (Jun. '37), Kirzade Apartment 6 doire, Istanbul, Turkey.

Shea, Joseph Thomas (Assoc. M. '37), Constr. Engr., City of Boston, Building Dept., 901 City Hall Annex, Boston, Mass.

Simonini, Constant Leonard (Jun. '37), 60 Cedar St., Providence, R.I.

Simpson, Ralph Ervin (Assoc. M. '37), Sales Engr., Lone Star Cement Corporation, 237 Blue Ridge Rd., Indianapolis, Ind.

Skinner, Harry Ellsworth (Jun. '37), 715 Ferree St., Coraopolis, Pa.

Soderberg, Richard Gottfried (Jun. '37), Asst. Eng. Draftsman, U. S. Engrs., Rock Island, Ill. (Res., 1788 Hewitt Ave., St. Paul, Minn.)

Stackhouse, John Llewelyn (Assoc. M. '37), Constr. Asst., State Highway Dept. (Res., 2409 Franklin St.), Olympia, Wash.

Steel, Ernest William (M. '37), Prof. and Head of Dept., Municipal and San. Eng., Agri. and Mech. Coll. of Texas, Box 273, College Station, Tex.

Stevens, Victor George (Jun. '37), New Hartford, Conn.

Stevenson, Albert Henry (Jun. '37), Junior San. Engr., State Dept. of Health, 411 Herald Bldg. (Res., 201 Scott Ave.), Syracuse, N.Y.

Stipp, John Robert (Jun. '37), Junior Highway Engr., State Div. of Highways, Dieterich, Ill.

Syndennis, Elmer Joseph (Jun. '37), 33 Edgar Terrace, Tompkinsville, N.Y.

Taylor, Ernest William, Jr. (Jun. '37), 2170 Fifth Ave., Bay City, Mich.

Tondro, Lyman William (Jun. '37), 525 Wensley Ave., El Centro, Calif.

Traube, Clarence James Brendan (Jun. '37), 369 West 48th St., New York, N.Y.

Troxell, Willard Wilson (M. '37), Industrial Economist, FSA, U. S. Dept. of Agriculture, Washington, D.C. (Res., 3714 Winterbourne Rd., Baltimore, Md.)

Turnbell, Robert Charles (Jun. '37), 757 East Clinton St., Frankfort, Ind.

Upp, Ronald Jocelyn (Jun. '37), Napoleon, Ohio.

Van Dyke, Alfred John (Assoc. M. '37), Res. Engr., State Highway Dept., Grandview, Tex.

Van Zandt, Franklin Keller (Assoc. M. '37), Asst. Topographic Engr., U. S. Geological Survey, Sacramento, Calif.

Vogt, John Edward (Jun. '37), San. Engr., Isabella County Health Unit, 317 North Franklin St., Mount Pleasant, Mich.

Wait, John Russell, Jr. (Jun. '37), Care, Eng. Dept., United Gas Pipe Line Co., Box 2492, Houston, Tex.

Wallis, William Richard (Assoc. M. '37), Bridge Designer, State Highway Dept., Austin, Tex.

Wallis, William Russell, Jr. (Jun. '37), Chf. of Party, Channel Inspection and Survey Boat, U. S. Engr. Office; R.D. 5, Box 83, Austin, Tex.

Wardwell, Frank Carlton (Assoc. M. '37), Senior Civ. Engr., TVA, Chickamauga Dam (Res., 1424 Hixson Rd.), Chattanooga, Tenn.

Watford, Troy Ellis (Assoc. M. '37), City Engr., City Hall, Gadsden, Ala.

Williams, Elias Jonce, Jr. (Assoc. M. '37), Asst. Engr., Mississippi River Comm. (Res., 3100 Laughlin St.), Vicksburg, Miss.

Williams, Stephen Asa (Jun. '37), Company 711, CCC, Ely, Minn.

Woo, Harry Bo-Wing (Jun. '37), 2177 West 7th St., Brooklyn, N.Y.

Wood, Leonard Denny, Jr. (Jun. '37), With Am. Rolling Mill Co. (Res., 116 South Main St.), Middletown, Ohio.

Woodward, John Wesley (Jun. '37), Levelman, Pacific Gas & Elec. Co., San Francisco (Res., 1112 Gay St., Susanville), Calif.

Zelnick, Ernest William (Jun. '37), With Illinois Water Service Co., Champaign (Res., 2342 Elmwood Ave., Berwyn), Ill.

MEMBERSHIP TRANSFERS

Africano, Alfred (Jun. '33; Assoc. M. '37), Asst. Engr., Interborough Rapid Transit Co., 2545 Seventh Ave., New York, N.Y.

Birdsall, Blair (Jun. '31; Assoc. M. '37), Engr., John A. Roebling's Sons Co., Bridge Dept. (Res., 263 Highland Ave.), Trenton, N.J.

Bourland, Charles Rice (Assoc. M. '24; M. '37), Supt., Koppers Coal Co., Helen, W.Va.

Croom, William Puryear, Jr. (Jun. '29; Assoc. M. '37), Asst. City Engr. and Asst. Director of Public Works, City of Danville, Box 394, Danville, Va.

Gewertz, Moe William (Jun. '30; Assoc. M. '37), Asst. Bridge Constr. Engr., State Div. of Highways, Bridge Dept., Box 1499, Sacramento, Calif.

Goddard, James Elmer (Jun. '28; Assoc. M. '37), Hydr. Engr., Hydr. Data Div., TVA, Knoxville, Tenn.

Guyer, George Allen (Jun. '27; Assoc. M. '37), Associate Engr., U. S. Engr. Office, New Federal Bldg. (Res., 920 Norwich Ave., Brookline, South Hills), Pittsburgh, Pa.

Harrold, John Coate (Jun. '28; Assoc. M. '37), Engr., Office of Chf. of Engrs., U.S.A., Room 2743 Munitions Bldg., Washington, D.C.

Hose, Harold Clarence (Jun. '27; Assoc. M. '37), Chf. Engr., The Texas Co., Refining Dept., 135 East 42d St., New York, N.Y.

Jackson, James William, Jr. (Jun. '30; Assoc. M. '37), Structural Designer, Aluminum Co. of America (Res., 715 Wisteria Ave., Mount Lebanon), Pittsburgh, Pa.

Jarman, Junius Thomas (Jun. '28; Assoc. M. '37), Ensign, U. S. Coast and Geodetic Survey, Washington, D.C.

Johnson, Ralph Peter (Jun. '28; Assoc. M. '37), Associate Engr., U. S. Engrs., U. S. Engr. Office, Box 523, Conchas Dam, N.Mex.

Kettle, Kenath Austin (Jun. '33; Assoc. M. '37), Chf. Draftsman, Carbide & Carbon Chemicals Corporation, 437 McCorkle Ave., South Charleston (Res., 1506 Virginia St., Charleston), W.Va.

LeVan, James Henry (Jun. '26; Assoc. M. '37), Passed Asst. San. Engr., U. S. Public Health Service, Officer in Chg., Scioto River Investigation, Box 87, Chillicothe, Ohio.

Patterson, Robert Shepherd (Jun. '31; Assoc. M. '37), Designer, Black & Veatch, 4706 Broadway (Res., 6431 McGee St.), Kansas City, Mo.

Ranta, Toivo Walder (Jun. '30; Assoc. M. '37), Asst. Topographic Engr., U. S. Geological Survey, Box 346, Sacramento, Calif.

Templin, Newton Henry (Jun. '28; Assoc. M. '37), Asst. Dist. Engr., Los Angeles County Road Dept., 1104 Hall of Records, Los Angeles (Res., 331 North Cerritos Ave., Downey), Calif.

Tucker, John Thomas (Jun. '31; Assoc. M. '37), Engr., PWA for Montana (Res., 527 Broadway), Helena, Mont.

Van Hook, Elliott Boyd (Jun. '22; Assoc. M. '29; M. '37), Structural Designer, E. I. du Pont de Nemours & Co., Wilmington, Del. (Res., 1257 Marlyn Rd., Overbrook, Philadelphia, Pa.)

Voelker, Robert Andrée (Jun. '30; Assoc. M. '37), Instr., Civ. Eng., Antioch Coll., Yellow Springs, Ohio.

Wiesner, Henry, Jr. (Jun. '33; Assoc. M. '37), With Filtration Engrs., Inc., 858 Summer Ave. (Res., 370 Summer Ave.), Newark, N.J.

Wiley, Tarley Tarson (Jun. '31; Assoc. M. '37), Asst. Engr., Traffic and Safety Section, State Div. of Highways (Res., 1622 North 5th St.), Springfield, Ill.

Williams, Eugene Lingenfelter (Assoc. M. '23; M. '37), Supt. of Constr., State Building

Comm., Jefferson City (Res., 1101 University, Columbia), Mo.

Wolfskill, Kenneth Barnett (Jun. '27; Assoc. M. '37), Engr., Supervisor, Bridge Dept., State Highway Comm. (Res., 2317 College Ave.), Indianapolis, Ind.

Reinstatements

Brady, Virgil Rue, Assoc. M., reinstated July 12, 1937.

Larkin, William James, Jr., M., reinstated Oct. 27, 1937.

Lefebvre, William Clayton, Assoc. M., reinstated Oct. 26, 1937.

Resignations

Stirton, John Arthur, Jun., resigned Oct. 8, 1937.

Applications for Admission or Transfer

Condensed Records to Facilitate Comment of Members to Board of Direction

December 1, 1937 Number 12

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every member is urged, therefore, to scan carefully the list of candidates published each month in Civil Engineering *and to furnish the Board with data which may aid in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board.

Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

Grade	General Requirement	Age	Length of Active Practice	Responsible Charge of Work
Member	Qualified to design as well as to direct important work	35 years	12 years*	5 years of important work
Associate Member	Qualified to direct work	27 years	8 years*	1 year
Junior	Qualified for sub-professional work	20 years†	4 years*	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years*	5 years of important work
Fellow	Contributor to the permanent funds of the Society			

* Graduation from an engineering school of recognized reputation is equivalent to 4 years of active practice.

† Membership ceases at age of 33 unless transferred to higher grade.

The fact that applicants refer to certain members does not necessarily mean that such members endorse.

ADMISSIONS

Anderson, Gustaf Albert, Oakland, Calif. (Age 32.) Constr. Engr., Safeway Stores, Inc. Refers to G. M. Dillingham, J. C. Doucha, C. G. Hyde, R. R. Rowe, C. T. Wiskocil.

Anderson, Randolph Erland, Eltingville, N.Y. (Age 25.) Refers to A. Rheinstein, C. T. Schwarze.

Barney, William Joshua, Jr., New York City. (Age 26.) With W. J. Barney Corporation. Refers to W. J. Barney, E. H. Faile, A. T. Glassett.

Bowen, John Edmund, Detroit, Mich. (Age 33.) Asst. Structural Engr., Eng. Dept., Great Lakes Steel Corporation. Refers to E. H. Anson, P. S. Baker, E. F. Ball, C. Dillenbeck, M. A. Schutz, C. C. Singleton.

Butler, Vaden Reynolds, Scotia, N.Y. (Age 22.) Refers to R. W. Abbett, W. C. Taylor.

Cahn, Charles Alexander, New Haven, Conn. (Age 27.) Private practice under name, Office of Alexander Cahn. Refers to W. V. Barry, C. T. Bishop, C. M. Blair, R. H. Suttie, J. C. Tracy.

Callahan, Joseph Cal, Cincinnati, Ohio. (Age 27.) At present engaged in private traffic research. Refers to W. J. Emmons, W. C. Hoad, B. W. Marsh, D. G. Mickle, R. L. Morrison, F. C. Taylor, J. S. Worley.

Casey, Thomas Bernard, Chicago, Ill. (Age 45.) Dist. Engr. and Chf. of Bureau of Rivers and Lakes Control, State Div. of Waterways, Springfield, Ill. Refers to L. H. Corning, G. L. Freeman, L. J. Hotchkiss, G. Jeppesen, W. M. Smith.

Converse, Willard Blake, Buffalo, N.Y. (Age 53.) Field Engr., Buffalo Sewer Authority. Refers to J. H. Feigel, R. S. Moore, W. K. Peasley, G. J. Summers, J. R. Van Duyne.

Dana, Forest Charles, Ames, Iowa. (Age 51.) Associate Prof. of Eng. Problems, and Prof. of Gen. Eng., Iowa State Coll. Refers to T. R. Agg, R. A. Caughey, A. H. Fuller, H. J. Gilkey, F. Kerekes, A. Marston, C. C. More.

DeBerry, Bannister Luther, Sherman, Tex. (Age 23.) Refers to E. C. H. Bantel, P. M. Ferguson, J. A. Focht.

Donovan, John Padraic, Philadelphia, Pa. (Age 38.) In private practice. Refers to F. W. Abbott, J. Adler, J. Cantley, J. L. Fawley, G. V. Keely, L. L. Lessig, J. J. Sweeney.

Drager, Frederick Eugene, Moscow, Idaho. (Age 29.) Instructor in Civ. Eng., Coll. of Eng., Univ. of Idaho. Refers to I. C. Crawford, J. W. Howard.

Duberstein, Philip, New York City. (Age 27.) Refers to R. E. Goodwin, J. C. Rathbun.

Dunn, Clark Allan, Stillwater, Okla. (Age 36.) Associate Prof. of Civ. Eng., Oklahoma Agricultural and Mechanical Coll. Refers to N. B. Garver, J. E. Kirkham, R. E. Means, R. G. Saxton, E. R. Stapley.

Edwards, Maxwell Charles, Brooklyn, N.Y. (Age 20.) Refers to W. Allan, R. E. Goodwin, T. H. Prentice, J. C. Rathbun, W. L. Willig.

Erickson, David William, Nespelem, Wash. (Age 33.) Road Engr., U. S. Indian Service, Colville Indian Agency. Refers to H. J. Doolittle, C. A. Hoglund, P. G. Holgren, S. C. Jayne, C. Nash.

Evans, John Carlyle, New York City. (Age 54.) Chf. Engr., Port of New York Authority. Refers to O. H. Ammann, A. Dana, J. Forgie, H. W. Hudson, G. L. Lucas, G. S. Reeves, C. E. Trout.

Guscio, Francis Joseph, Richmond, Va. (Age 31.) Associate Engr., Regional Staff Engr., National Park Service. Refers to A. P. Andersen, M. B. Case, W. A. Cuenot, L. M. Gray, E. F. Preece, O. G. Taylor, R. G. Wheadon.

Hertzler, Richard Adin, Dillard, Ga. (Age 31.) Supt., Coweeta Experimental Forest, U. S. Forest Service. Refers to E. D. Burchard, H. W. King, C. O. Wisler.

Kelemen, Frank Kenneth, New York City. (Age 23.) Draftsman, Gibbs & Hill. Refers to R. C. Brumfield, F. E. Foss, G. Morrison, M. H. Van Buren.

Kirkham, Rowland Edward, Stillwater, Okla. (Age 40.) Associate Prof. of Civ. Eng., Oklahoma A. & M. Coll. Refers to J. M. Brown, J. S. Dodds, A. Marston, R. E. Means, E. R. Stapley.

Leichtman, Adolph, Brooklyn, N.Y. (Age 23.) Refers to W. Allan, R. E. Goodwin.

Lichtman, Irving, Brooklyn, N.Y. (Age 44.) Pres., Tri-State Bldg. Co., Engrs. and Contrs. Refers to E. Balaban, D. W. Coe, M. E. Gilmore, J. H. Griffin, A. Haring, N. Meyer, J. B. Snow, H. C. T. Toensfeldt.

Lothers, John Edmond, Stillwater, Okla. (Age 48.) Associate Prof. of Architecture, Oklahoma A. & M. Coll. Refers to J. M. Garrelts, A. Hedefine, J. E. Kirkham, R. E. Means, T. C. Shedd, E. R. Stapley.

Lyon, Robert Dorsey, Bayville, N.Y. (Age 32.) Transitman (Chf. of Party), County Engr.'s Office, Nassau County, N.Y. Refers to W. H. Bowne, K. Forrest, J. C. N. Guibert, G. H. Peters, F. W. Saunderson, W. F. Starks, W. W. Stone, H. J. Switzer.

Maguire, George Campbell, New York City, (Age 56.) Engr. with Coverdale & Colpitts. Cons. Engrs. Refers to G. H. Burgess, G. W.

Burpee, W. W. Colpitts, W. H. Coverdale, H. B. Holmes, J. H. S. Melville, E. F. Wendt.

May, Joseph Otto, Ridgewood, N.J. (Age 48.) Engr., American Bridge Co., New York City. Refers to H. C. Baird, J. B. French, C. F. Goodrich, R. R. Graham, O. E. Hovey, E. Mowlds, S. J. Ott, J. E. Wadsworth, F. P. Witmer.

Moore, Gerald Dixon, New York City. (Age 28.) Inspector of Real Estate, Emigrant Industrial Savings Bank. Refers to J. J. Costa, J. B. Martin, F. A. O'Hare.

Moore, William Irvine, Douglas, Wyo. (Age 25.) Refers to R. D. Goodrich, H. T. Person.

Mortola, Alexis Joseph, Kew Gardens, N.Y. (Age 31.) Post-graduate student, Polytechnic Inst. of Brooklyn. Refers to C. W. Coote, H. P. Hammond, E. J. Squire.

Orr, William Robert, Caballo, N. Mex. (Age 25.) Eng. Draftsman, U. S. Bureau of Reclamation. Refers to J. L. Brown, S. F. Crecelius, F. J. Thomas, V. J. Von Schoeler, W. A. Von Schoeler.

Patterson, Albert Earl, Sitka, Alaska. (Age 52.) Constr. Engr., Field Force, Procurement Div. Public Bldgs. Branch, Treasury Dept., Washington, D.C. Refers to W. L. Huber, N. A. Melick, C. H. Rhudy, J. B. Warrack, E. J. Waugh.

Quinn, John Dewey, Cheyenne, Wyo. (Age 40.) State Engr., State of Wyoming. Refers to H. F. Bell, E. B. Debler, R. Follansbee, R. D. Goodrich, M. C. Hinderlider, G. T. Kuntz, E. K. Nelson.

Ragsdale, Theron Wright, Ft. Peck, Mont. (Age 39.) Prin. Asst., Asst. Chf. of Operations, Ft. Peck Engr. Dist., U. S. Engr. Office. Refers to T. C. Forrest, Jr., C. Kittrell, T. B. Larkin, J. C. H. Lee, E. L. Myers, E. N. Noyes, K. R. Young.

Reed, Paul William, Ft. Wayne, Ind. (Age 23.) Studying for M.S. in Public Health, Univ. of Mich. Refers to C. A. Ellis, H. E. Miller, R. B. Wiley.

Reinhardt, Charles Orville, Champaign, Ill. (Age 26.) Asst. Engr., State Water Survey, Urbana, Ill. Refers to J. J. Doland, M. L. Enger, W. D. Gerber, G. W. Pickels, M. Suter.

Roberts, Kenneth Lindsey, New Haven, Conn. (Age 35.) Associate Conservationist (under Director of Northeastern Forest Experiment Station), U. S. Forest Service. Refers to F. A. Barnes, C. A. Betts, J. E. Perry, F. J. Spry, P. H. Underwood.

Rochlin, Sidney, Showlow, Ariz. (Age 25.) Structure Inspector, Arizona Highway Dept. Refers to E. S. Borgquist, F. C. Kelton, J. C. Park, J. W. Powers, A. F. Rath, S. Smyth.

Ruhlen, Harold Hunt, Vicksburg, Miss. (Age 31.) Jun. Engr., U. S. Engrs. Refers to O. G. Baxter, W. M. Borgwardt, F. J. Brown, F. C. Carey, E. W. Digges, J. B. Leslie, L. F. Reynolds, W. S. Thomson.

Seitz, Bradley George, Binghamton, N.Y. (Age 28.) Jun. Engr., U. S. Engr. Office. Refers to W. B. Anthony, L. L. Davis, E. M. Graf, J. L. Southworth, H. C. Woods.

Shanley, Edmund Michael, San Francisco, Calif. (Age 27.) Jun. Civ. Engr., and Res. Engr. on bridge construction, U. S. Forest Service. Refers to R. E. Davis, C. Derleth, Jr., B. A. Etcheverry, H. H. Hodgeson, E. R. Huber, W. L. Huber, C. G. Hyde, F. H. Tibbetts.

Sherick, Ralph Marshall, Crescent City, Calif. (Age 34.) Res. Engr., State of California. Refers to P. Beerman, I. O. Jahlstrom, F. W. Panhorst, D. R. Warren, P. R. Watson.

Spiegel, Milton, Chicago, Ill. (Age 30.) San. Engr., Sewage Equipment Div., Chicago Pump Co. Refers to M. M. Cohn, L. H. Enslow, A. E. Gorman, I. C. Peterson, W. E. Stanley, R. B. Wiley.

Sternitzke, Robert Frederick, Brooklyn, N.Y. (Age 20.) Refers to L. V. Carpenter, A. Haring, T. Saville, C. T. Schwarze, D. S. Trowbridge.

Sumner, Leslie Graham, West Hartford, Conn. (Age 46.) Engr. of Bridges and Structures, Connecticut State Highway Dept., Hartford, Conn. Refers to C. J. Bennett, C. T. Bishop, A. W. Bushell, C. S. Farnham, W. G. Grove, S. J. Ott.

Tippy, Kenneth Clem, Chicago, Ill. (Age 32.) Field Engr., Portland Cement Association. Refers to H. Cross, T. Germundsson, W. C. Huntington, H. R. McBirney, G. W. Pickels, W. M. Wilson, W. R. Young.

Van Antwerp, Frederick, Portland, Ore. (Age 51.) Engr. and Supt., Parker-Schram Co. Refers to J. W. Cunningham, D. B. Fegles, W. P. Hughes, R. E. Koon, S. Macomber, F. E. Nichol, T. Shoemaker, E. C. Willard.

Vassalotti, Frank John, Baltimore, Md. (Age 22.) Jun. Draftsman, Pennsylvania Water & Power Co. Refers to R. B. H. Begg, F. J. Sette.

Veigel, Louis Walter, Dickinson, N. Dak. (Age 28.) City Engr., Dickinson, N.Dak., and County Engr., Stark County, N.Dak. Refers to A. Boyd, S. M. Brown, E. F. Chandler, C. Johnson, W. H. Robinson.

Weyant, Halstead William, New York City. (Age 25.) Asst. Dispatcher with Lee & Simmons, Inc. Refers to C. T. Schwarze, D. S. Trowbridge.

Whitty, Howard Charles, Jr., Red Bluff, Calif. (Age 29.) Jun. Bridge Constr. Engr., Bridge Dept., California Highway Dept. Refers to F. S. Foote, R. E. Fowle, I. O. Jahlstrom, B. Jameyson.

Zeigler, William Lewis, Bethlehem, Pa. (Age 31.) Refers to H. R. McBirney, L. K. Maires, N. Rorhus, R. Sailer, C. P. P. Vetter.

FOR TRANSFER

FROM THE GRADE OF ASSOCIATE MEMBER

Andrews, Eric Alexis, Assoc. M., White Plains, N.Y. (Elected Junior Dec. 3, 1928; Assoc. M. July 4, 1932.) (Age 35.) Engr. of Sewers, Dept. of Public Works. Refers to T. A. Avery, F. A. Barnes, R. H. Gould, J. E. Perry, F. C. Zeigler.

Coburn, Charles Lyman, Assoc. M., Lexington, Mass. (Elected July 15, 1929.) (Age 42.) Associate Civ. Engr., Metropolitan Dist. Water Supply Comm., Boston, Mass. Refers to R. S. Holmgren, E. C. Hultman, K. R. Kennison, W. W. Peabody, F. E. Winsor.

Cocco, Miguel Angel, Assoc. M., New York City. (Elected April 23, 1928.) (Age 47.) Refers to J. M. Adams, J. W. Beardsley, J. L. Crider, M. Ferrer, H. J. Krueger, S. J. Ott, G. S. Rinehart.

Elmendorf, Harold Benjamin, Assoc. M., Amarillo, Tex. (Elected July 14, 1930.) (Age 44.) Regional Engr., Resettlement Administration, and U. S. Dept. of Agriculture. Refers to E. L. Barrows, P. R. Burn, W. T. Collings, Jr., G. F. Conroy, P. S. Fox, J. E. Hayes, T. M. McClure, A. O. Peabody, V. L. Sullivan, W. H. W. Yeo.

Gongwer, James Minnick, Assoc. M., Washington, D.C. (Elected Junior July 11, 1927; Assoc. M. March 11, 1929.) (Age 36.) With Thomas W. Marshall as Civ. Engr. and Prin. Asst. Refers to S. Charles, T. W. Marshall, J. W. Oehmann, A. J. Scullen, G. B. Strickler.

Hammelef, Peter Christensen, Assoc. M., Omaha, Nebr. (Elected June 1, 1925.) (Age 43.) Associate Highway Engr., U. S. Bureau of Public Roads. Refers to E. L. Brown, C. H. Buckius, A. W. Paine, C. Shoemaker, H. E. Snyder, H. J. Spelman.

Hein, Peter Leo, Assoc. M., Chicago, Ill. (Elected June 16, 1919.) (Age 53.) Lieberman & Hein; also Inspection Engr. with Treasury Dept., Procurement Div., Public Bldgs. Branch; member of Advisory Comm. on Structural Eng. Refers to J. W. Emig, E. Lieberman, A. E. Lindau, H. Penn, L. E. Philbrook, C. L. Post, A. F. Reichmann, A. W. Stephens, I. F. Stern, C. H. Westcott.

Kehart, Martin William, Assoc. M., DeQueen, Ark. (Elected April 25, 1932.) (Age 35.) Res. Engr., Arkansas State Highway Comm., Bridge Dept. Refers to O. G. Baxter, H. Cross, N. B. Garver, W. C. Huntington, D. A. MacCrea, J. M. Page, J. R. Rhyne, W. W. Zass.

Locraft, Bernard Francis, Assoc. M., Washington, D.C. (Elected Jan. 28, 1935.) (Age 35.) Berrall & Locraft, Engrs. Refers to R. Coltman, Jr., F. F. Gillen, H. M. Lloyd, T. W. Marshall, M. S. Rich, A. J. Scullen, G. B. Strickler.

Nagel, Charles August, Assoc. M., Wauwatosa, Wis. (Elected June 7, 1926.) (Age 40.) Supt. of Constr. and Designer with Lawrence E. Peterson, Cons. Engr., Milwaukee, Wis. Refers to H. E. Babbitt, L. S. Dixon, J. Donohue, J. L. Ferebee, H. F. Gonnerman, E. Hancock, A. L. Kurtz.

Norton, Irwin Gilbert, Assoc. M., Memphis, Tenn. (Elected Jan. 26, 1931.) (Age 35.) Partner, Walter F. Schulz, Cons. Engr. and Archt. Refers to J. H. Haylow, L. L. Hidinger, H. N. Pharr, W. F. Schulz, V. H. Smith.

Peterson, Lawrence Eugene, Assoc. M., Milwaukee, Wis. (Elected July 16, 1928.) (Age 40.) Cons. Engr. Refers to H. G. Balcom, W. C. Huntington, F. A. Randall, A. Smith, W. M. Wilson.

Stanley, William Edward, Assoc. M., Ithaca, N.Y. (Elected Junior May 31, 1916; Assoc. M., July 9, 1923.) (Age 46.) Prof. of San. Eng., Cornell Univ. Refers to L. E. Conrad, W. S. Gearhart, S. A. Greeley, P. Hansen, L. Pearse, A. P. Poorman, R. L. Sackett, A. K. Warren.

Ulrich, Franklin Peter, Assoc. M., San Francisco, Calif. (Elected June 9, 1930.) (Age 46.) Magnetic Observer with U. S. Coast and Geodetic Survey. Refers to N. A. Bowers, H. D. Dewell, E. W. Eickelberg, N. H. Heck, R. V. Labarre, R. R. Martel, C. D. Wailes, Jr.

Zack, Samuel Isador, Assoc. M., New York City. (Elected June 9, 1930.) (Age 37.) San. Engr., Filtration Equipment Corporation. Refers to F. Bass, W. N. Carey, G. C. Clarke, C. E. Fraser, S. A. Greeley, L. Pearse, F. M. Veatch, L. C. Whittemore.

From the Grade of Junior

Ashbridge, Whitney, Jun., Downingtown, Pa. (Elected Oct. 1, 1926.) (Age 33.) Capt., U. S. Army, Engr. Reserve. Refers to W. E. Belcher, C. W. Cochran, C. S. Landers, F. D. Shaw, M. J. Young.

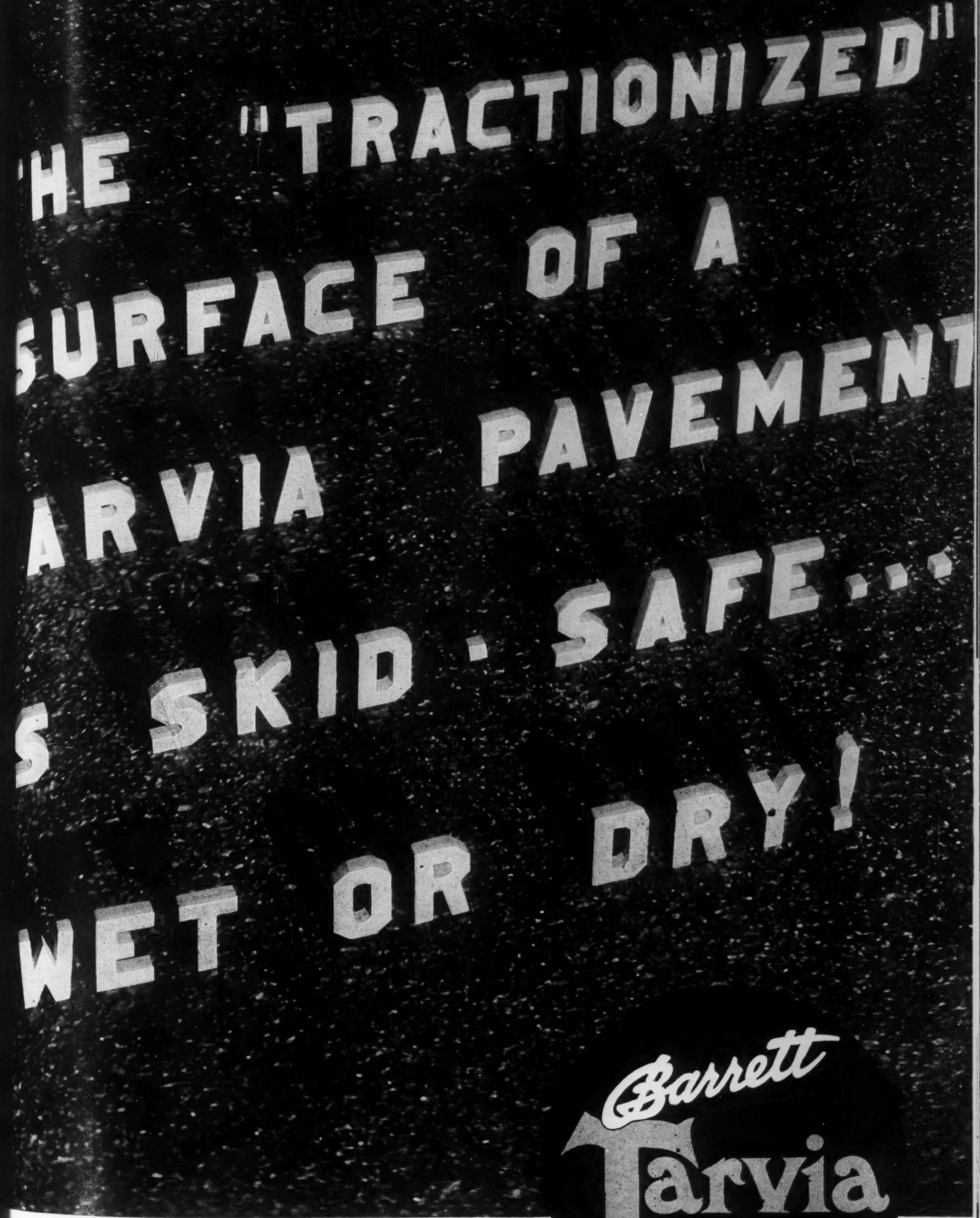
Bangert, Nelson Richard, Jun., Sacramento, Calif. (Elected March 11, 1929.) (Age 32.) Asst. Maintenance Engr., California Div. of Highways. Refers to T. A. Bedford, S. V. Cortelyou, E. Evers, R. M. Gillis, E. Q. Sullivan.

Bracey, Smith Herbert, Jun., Algood, Tenn. (Elected Sept. 9, 1935.) (Age 32.) Supt., Marion Constr. Co. Refers to H. T. Ammerman, E. W. Bauman, T. L. Bransford, C. W. Butts, M. P. Jones, R. S. Lillard, J. E. Moreland.

Chapton, Herbert Joseph, Jun., Bishop, Calif. (Elected Jan. 13, 1936.) (Age 32.) Office Engr., Mono Basin Project. Refers to H. P. Bliss, W. W. Hurlbut, H. L. Jacques, J. E. Jones, E. B. Mayer, S. B. S. Nelson, W. W. Wyckoff.

Culver, Lewis Matson, Jun., Denver, Colo. (Elected Oct. 1, 1926.) (Age 32.) Asst. Engr., U. S. Bureau of Reclamation. Refers to H. H. Bennet, C. A. Betts, F. B. Cook, Jr., C. L. Eckel, E. M. Kelly, J. B. Wells.

Engel, Harry John, Jun., Harrisburg, Pa. (Elected Oct. 1, 1926.) (Age 32.) Asst. Engr., Modjeski, Masters & Case, Philadel-


HE "TRACTIONIZED"
URFACE OF A
ARVIA PAVEMENT
S SKID - SAFE...
WET OR DRY!

Barrett
Tarvia
GOOD ROADS
AT LOW COST

BARRETT COMPANY New York Chicago Birmingham
Detroit Buffalo Providence Lebanon Rochester Baltimore Minneapolis
Columbus Philadelphia Toledo Youngstown Syracuse Hartford
Milwaukee Cincinnati Bethlehem Portland, Me. Norwood, N. Y.
THE BARRETT COMPANY, LTD. Montreal Toronto Winnipeg Vancouver

and Polytechnic Institute of Brooklyn; 2 years in charge of development of hundred-acre park; experience, also, as engineering assistant, inspector of highways, and in charge of personnel. Now engaged as inspector of dredging operations. Desires to enter city planning field. Holds commission as captain, Officers Reserve Corps. Location immaterial. D-2304.

Municipal or Highway Engineer and City Manager; Assoc. M. Am. Soc. C.E.; age 43; married; graduate civil engineer; Michigan registration; capable administrator and executive; 8 years as city engineer; 6 years on highway; 8 years as city manager. Available immediately. A-1941.

Geodetic Engineer and Geographer; Assoc. M. Am. Soc. C.E.; 28 years of engineering, including location and construction of highways and railroads; irrigation projects; geodetic engineering; astronomical operations determining precise latitude and longitude for aero-photographic surveys and boundary location in Latin-Americas and Africa; owns instrumental equipment for astronomical operations; speaks Spanish, German, French. C-5052.

Junior

Civil Engineer; Jun. Am. Soc. C.E.; 23; single; A.B., Dartmouth College, 1935; C.E., Thayer School of Civil Engineering, 1936; desires opportunity in any branch of civil engineering. Location immaterial. Available. D-5489.

Civil Engineer; Jun. Am. Soc. C.E.; 23; single; B.S. in C.E., Newark College of Engineering, 1935; some M.E. training. Several months experience in traffic work; $1\frac{1}{2}$ years experience in appraisal and valuation work. Desires opportunity in any branch of civil engineering. Location immaterial. Available immediately. D-5556.

Hydraulic Engineer; Jun. Am. Soc. C.E.; single; 26; Purdue University, B.S., C.E., 1931; postgraduate work in concrete design and construction, 1931–1932; 1 year as research and teaching assistant in hydraulics laboratory; 2 years as designing engineer and detailer on hydraulic structures. Experience includes designing and detailing dams and powerhouses, and hydrology studies. Employed; available on reasonable notice. D-5463.

Civil Engineer; Jun. Am. Soc. C.E.; 22; B.S., C.E., New York University, 1934; 5 months as rodman and transitman, New York City Department of Parks, topographical and construction surveys; 5 months as surveyman, U. S. Engineers, New York-Pennsylvania flood-control survey; $2\frac{1}{2}$ months on line and grade, construction of concrete bleachers, Yankee Stadium, New York. Desires civil engineering position. Available. D-4300.

Civil Engineer; Jun. Am. Soc. C.E.; 23; married; B.S. in C.E., New York University; 1 year in Department of Highways under WPA—New York City, designing and drafting. Desires opportunity in any branch of civil engineering, preferably in New York City. Salary secondary. D-2992.

Civil Engineer; Jun. Am. Soc. C.E.; 29; single; B.S., C.E., Missouri School of Mines, 1933; 3 years experience on river and harbor survey and construction work. Employment with engineering or contracting firm desired. Available on two weeks notice. Location immaterial. D-5595.

Civil Engineer; Jun. Am. Soc. C.E.; 24; B.S., C.E., Lehigh University, 1933, high honors; 3 summers as assistant in surveying school; $3\frac{1}{2}$ years on flood-control projects, three rolled-earth dams, concrete work, including inspection, surveying; $1\frac{1}{2}$ years in charge of soils and concrete laboratory. Desires position with engineering firm in dams, structures, or other field. Location eastern United States. Available in three weeks. D-5603.

Civil Engineer; Jun. Am. Soc. C.E.; 25; single; B.S., C.E., Pennsylvania State College, 1932; 2 years managerial experience, steamship company and oil transportation; 8 months experience maintenance work, oil pipe line; 6 months, drafting and city surveying; 9 months, field work, steel erection of bridges and buildings. D-5606.

Miscellaneous

Licensed Civil and Structural Engineer; Assoc. M. Am. Soc. C.E.; registered surveyor with 15 years experience in design and construction of various types of reinforced concrete structures: 7 years as sales engineer; desires position as sales engineer, reinforced concrete designer, or in design and construction; instructor in concrete design in engineering school. Middle West preferred. D-5599.

Sales

Structural and Sales Engineer; Assoc. M. Am. Soc. C.E.; 43; married; graduate; high-grade sales executive, with over 15 years experience in sales, sales management, and structural engineering, specializing in steel requirements for bridges and buildings, solicits position with manufacturer or contractor. Qualified district sales manager. Good designer and estimator. Available soon. D-16.

Teaching

Instructor; Assoc. M. Am. Soc. C.E.; married; 42; graduate, C.E. degree; 13 years varied experience in city planning, highway and bridge design, and hydraulic studies. Party chief on precise survey. Commissioned in World War. Experience in executive capacity in hydraulic laboratory design; $2\frac{1}{2}$ years graduate teaching. Desires position as instructor in surveying, highways, hydraulics, sewage-water treatment, and design. Available February 1. D-875.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1936. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Elements of Probability. H. Levy and L. Roth. Oxford, England, Clarendon Press; New York, Oxford University Press, 1936. 200 pp., diagrs., charts, tables, 9 × 6 in., cloth, $5.

An elementary treatment of the subject in which the point of view is that "probability is an essential of scientific method, and that a probability estimate, however it is approached, has to be seen and interpreted as a guide in scientific procedure. At the same time, the authors have striven to provide a detailed criticism of the various self-contained theories of probability that have been advanced from time to time."

Physics of Solids and Fluids with Recent Developments. Pt. 2. By L. Prandtl, authorized translation by W. M. Deans. 2 ed. London and Glasgow, Blackie & Son, 1936. 392 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, 12s.6d.

This volume contains a translation of the articles on the equilibrium and flow of liquids and gases which Professor Prandtl contributed to the eleventh edition of Mueller-Pouillet's *Lehrbuch der Physik*. The present edition has been revised, considerable additions discussing recent work have been made, and a new chapter on the dynamics of gases has been included. There is a bibliography. The engineer will find much of value of the practical applications of hydrodynamics in the book.

Planning for City, State, Region and Nation. Proceedings of the Joint Conference on Planning, May 4–6, 1936, Richmond, Va. Chicago, American Society of Planning Officials (850 East 58th Street) 1936. 170 pp., 9 × 6 in., cloth, $2.

Among the subjects treated in this volume are the following: "City Planning and the Urbanism Study"; "Large-Scale Housing and the City Plan"; "Revision of Zoning Ordinances"; "Emerging Population Problems"; "State Planning and Legislative Planning"; and other topics.

The Professional Engineer. By Esther L. Brown. New York, the Russell Sage Foundation (130 East 22d Street), 1936. 85 pp., tables, diagrs., 8 × 5 in., paper, 75 cents.

This monograph is one of a proposed series dealing with the status of certain professions in the United States. Significant data obtained from interviews, questionnaires, books, periodicals, and unpublished studies have been assembled and interpreted for vocational counselors and others interested in the welfare of the profession. The study ends with a survey of recent trends, indicating the ability of the group to adjust itself to ever-changing social conditions.

Road Curves for Safe Modern Traffic and How to Set Them Out. By F. Royal-Dawson. London, E. & F. N. Spon, 1936. 246 pp., diagrs., charts, tables, 8 × 5 in., leather, 8s. 6d. + 6d. postage.

This work is an amplification of the principles outlined in the author's *Curve Design*, published in 1932, with the results of recent experience, and is intended as a companion to the main treatise. Emphasis is laid on the simplicity of the author's "unit-chord" system for solving curve problems, as compared with "degree" methods. Additional lemniscate tables are provided, and in this volume detailed spiral tables are also included.

Sewerage and Sewage Treatment. By W. A. Hardenbergh. Scranton, Pa., International Textbook Co., 1936. 396 pp., illus., diagrs., charts, tables, 8 × 5 in., leather, $3.50.

The aim of this book is to present a balanced, basic treatment of the subject, written from the realistic viewpoint of the practicing engineer, which will give the student a foundation for further study and also be of assistance to the engineer who is confronted only occasionally with sewerage problems.

Soil Erosion and Its Control. By Quincy C. Ayres. New York and London, McGraw-Hill Book Company, 1936. 365 pp., illus., tables, diagrs., charts, 9 × 6 in., cloth, $3.50.

This volume is intended to meet the need for a general treatise on erosion control for students in colleges and vocational agriculture departments, county agents, farmers, public officials, and others interested in the subject. It is believed that this is the first attempt to correlate all phases of the problem with the quantitative application of such data as are at present known. Special emphasis is accorded engineering phases of control.

Versuche an Eisenbetonbalken unter ruhenden und herabfallenden Lasten. By R. Saliger and E. Bittner. Vienna, Julius Springer, 1936. 79 pp., illus., diagrs., charts, tables, 11 × 8 in., paper 12 rm.

Gives the methods used and the results obtained in a study of the strength of reinforced concrete carried out in the research laboratory of the Vienna Technical High School. The resistance to static and impact stresses of beams reinforced with a variety of steels was determined.

Water Rights for Irrigation, Principles and Procedure for Engineers. By S. T. Harding. Stanford University Press, Stanford University, Calif., 1936. 176 pp., 9 × 6 in., cloth, $2.25.

This book has resulted from experience in teaching the subject, mainly to engineering students at the University of California, and as a practicing irrigation engineer. It includes the elements of law, engineering, and public policy in relation to this important resource of the western states. Special attention is given to riparian rights.

RIGHT TO THE EDGE EVERY TIME

ERE'S a drop of 57 feet where this "Caterpillar" sel Tractor is backfilling with a bulldozer on Los Angeles Metropolitan Aqueduct project r Riverside, Calif. — the positive and de- dable control of the tractor makes it a safe . It is one of a fleet engaged in backfilling 5 s of ditch. Their quick response and ease of rol bring them right to the edge every time — their sure traction holds them there.

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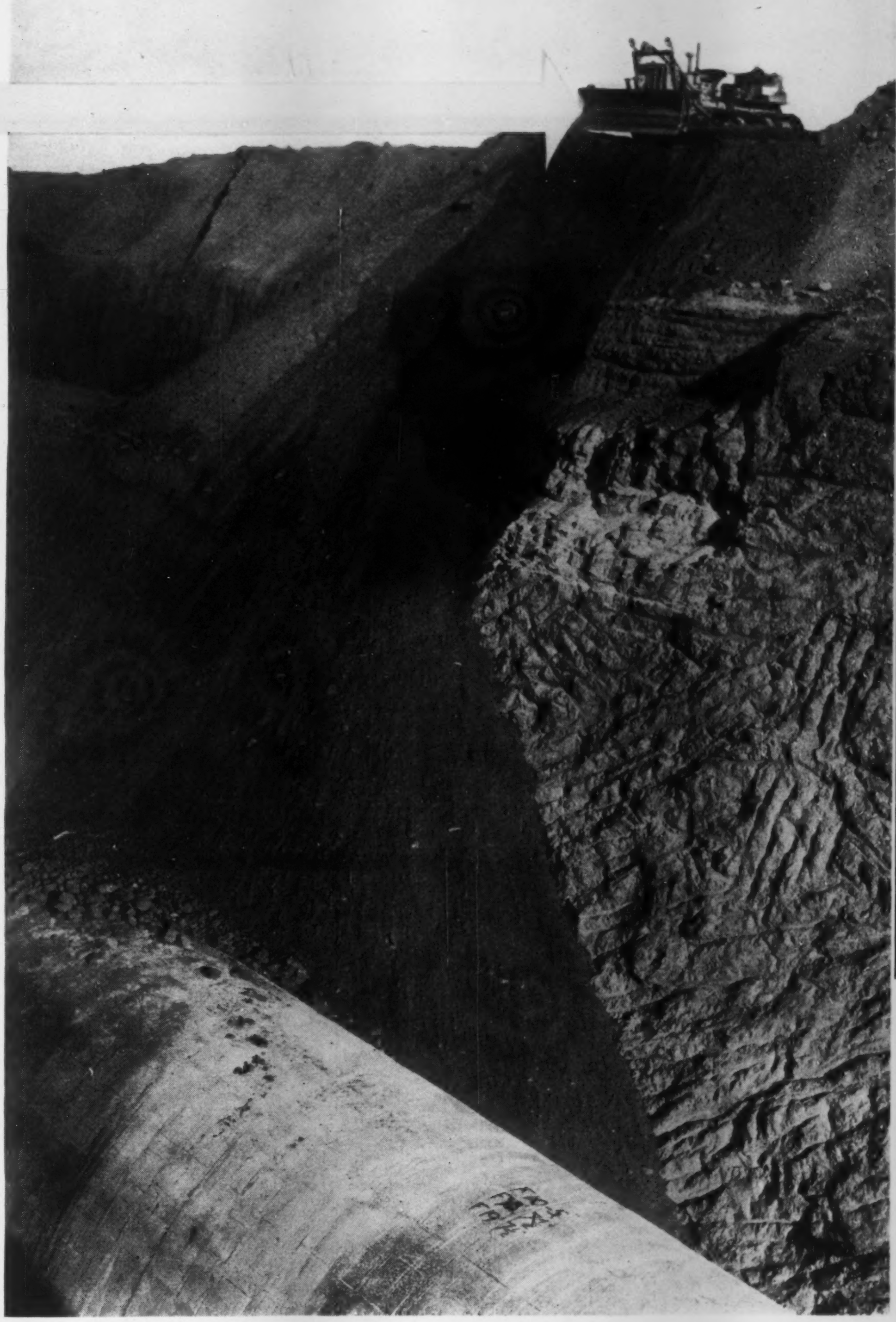

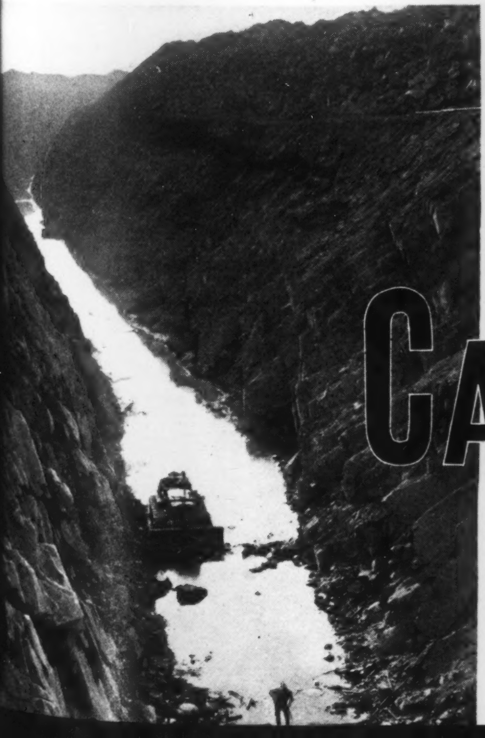

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CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

Concrete, Washington. Cellular Concrete Bridges Being Built in Washington. *Eng. News-Rec.*, vol. 117, no. 19, Nov. 5, 1936, pp. 637–638. Structural features of and cost data on several hollow-member concrete bridges, with spans ranging from 60 to 190 ft, recently completed, or under construction, in western Washington.

Highway. Highway Bridges and Traffic Requirements, P. L. Pratley. *Can. Engr.*, vol. 71, no. 12, Sept. 22, 1936, pp. 6–9. Factors influencing design of small highway bridges; determination of width and types of floors. Before Can. Good Roads Assn.

Piers, Strengthening. Welding and Cutting Play Important Rôles in Straightening of Tilted Bridge Pier. *Welding Engr.*, vol. 21, no. 6, June 1936, pp. 34–35. Welding and cutting operations involving novel applications have just been completed in connection with straightening and strengthening of Pier No. 2 of Columbia Highway cantilever bridge at Grand Coulee Dam in Washington; no construction job of like nature had ever before been undertaken, it is claimed.

Steel Arch, New York City. Special Problems of Hingeless Arch Erection, W. K. Greene. *Eng. News-Rec.*, vol. 117, no. 20, Nov. 12, 1936, pp. 669–673. Fabrication and construction of hingeless steel arch, 800 ft in span, of Henry Hudson Bridge in New York City; unusual accuracy in fabrication and careful crown jacking required to induce proper stress conditions in finished structure; falsework cage weighing 140 tons lowered to river bottom by derrick boat; steel H-piles driven through this cage to support bents; details of crown closure; deck construction.

Steel Arch, Sweden. Long Steel Arches Erected by Falsework Elevator. *Eng. News-Rec.*, vol. 117, no. 18, Oct. 29, 1936, pp. 606–609. Construction of West and Palsund bridges in Stockholm, Sweden, including hingeless arch of 668-ft span and all-welded 2-hinged arch of 183-ft span; half-arch spans were lifted at crown while rotating about pins at abutments; pipe columns supporting 78-ft deck; erection equipment consisted of deck traveler and cantilever falsework brackets that steadied and supported columns, floorbeam, and fascia stringers until they could be joined together.

Steel Truss, Construction. Cantilever Bridge Erected from One End, S. M. Smith. *Eng. News-Rec.*, vol. 117, no. 20, Nov. 12, 1936, pp. 690–692. Construction of Wabash Railway Company steel-truss bridge, 1,645 ft long, exclusive of approaches, with maximum span of 624 ft, over Missouri River at St. Charles, Mo.; erection of main spans was started with simple span, and was carried on by means of inside traveller supported on stringers and bottom chords of trusses; special deck construction; track characteristics.

Steel Truss, Germany. Die Elbbruecke der Reichsautobahn bei Dresden—II, Schreiner. *Bautechnik*, vol. 14, no. 6, Feb. 4, 1936, pp. 69–87. Detailed description of construction of roadway pavement of steel-truss bridge, 378 m long, carrying new German superhighway over Elbe River at Dresden; steel work erection; field welding methods.

Steel Truss, Hannibal, Mo. Long Continuous Truss Bridge Spans Mississippi River, J. I. Parcel. *Eng. News-Rec.*, vol. 117, no. 11, Sept. 10, 1936, pp. 362–364. Design and construction of new highway bridge over Mississippi River at Hannibal, Mo., consisting principally of 2-span continuous truss, 1,125 ft long, and through-trusses at either end, 300 ft long; specifications and loading; total cost of structure was $673,000.

Steel Truss Hungary. Shallow Continuous Trusses for Budapest Bridge, F. L. Ehasz. *Eng. News-Rec.*, vol. 117, no. 16, Oct. 15, 1936, pp. 545–546. Design and construction of Horthy Miklos highway bridge over Danube River, at Budapest, Hungary, consisting of continuous Warren deck trusses with verticals and curved lower chords; theoretical depth of 500-ft central span is only 13 ft; bridge will carry two trolley tracks and four vehicular lanes; deck consists of concrete-filled steel troughs and wood blocks.

Steel Truss, Moving. Verschiebung einer 2,000 t schweren zweigleisigen Eisenbahnbruecke bei Stettin, H. Wolf. *Bautechnik*, vol. 14, no. 8, Feb. 14, 1936, pp. 121–123. Method of moving 3-span steel-truss bridge, 225 m long, weighing 2,000 tons, for distance of 10.5 m upstream; bridge is located near Stettin, Germany, and carries two railroad tracks.

Strengthening. Strengthening of Weak Bridges, C. S. Chettoe. *Structural Engr.*, vol. 14 (new series), no. 2, Feb. 1936, pp. 62–84. Review of British practice in strengthening masonry and metallic bridges, mostly of short span. Before Instn. Structural Engrs. and British section of Societé des Ingenieurs Civils de France.

BUILDINGS

Earthquake Effects. Improved Theory of Energy Dissipation in Seismic Vibrations of Structure, K. Sezawa and K. Kanai. *Tokyo Imperial Univ.—Earthquake Research Inst.—Bul.*, vol. 14, pt. 2, June 1936, pp. 164–188. Simplest structure subjected to incident longitudinal waves; tall structure with rigid floors subjected to incident transverse waves; same, with flexible floors; general theory in case of framed structure; structure with rigid floors and clamped base, and various other cases, discussed mathematically.

Heating, Fuel Consumption. Vom Einfluss des Windes und seiner Folgen auf den Waermebedarf der Gebaeude, M. Hottinger. *Gesundheits-Ingenieur*, vol. 59, no. 16, Apr. 18, 1936, pp. 219–225. Investigations of effect of wind and accompanying phenomena on heat requirements of buildings; results of experiments carried out on small test house set up on roof of Physics Hall of Zurich Institute of Technology.

Moving. 13-Story Building Cut in Two and Set Back 5 Ft to Widen Street. *Construction Methods*, vol. 18, no. 2, Feb. 1936, p. 33. Method of moving front part of Commercial Exchange Building in Los Angeles, by cutting gap in building, for its full height and width, at point about 50 ft back from front, and then moving disconnected front unit of structure 5 ft to rear in order to close up openings.

Office, Heating. New Hamilton Federal Building Is Fully Air-Conditioned, J. Breakey. *Modern Power & Eng.*, vol. 30, no. 9, Sept. 1936, pp. 24–27, and 32. This 6-story building is one of the most modern in Canada; two 250-hp water tube boilers designed for pressure of 150 lb per sq in. installed to take care of heating, although usual working pressure will be only 25 lb per sq in.; for supply for forced draft to stokers, fan having capacity of 7,500 cu ft of air per min against 5-in. static pressure is installed.

Store Air Conditioned. Air Conditioning . . . World's Largest Shoe Store. *Domestic Eng.*, vol. 145, no. 4, Oct. 1936, pp. 76–78. Installation in 12-story store of R. H. Fyfe and Company, Detroit.

CITY AND REGIONAL PLANNING

Texas. Report of Texas Planning Board for 1935. Austin, Tex., Texas Planning Board, 1936. 103 pp., figs., diagrs., charts, tables. Brief historical sketch of Texas; geographic features of Texas; population and employment; publicity; committees of Texas Planning Board; Texas Planning Board law.

Watersheds. Die Wasserwirtschaftliche Generalplanung, Schroeder. *Gas- u Wasserfach*, vol. 79, no. 17, Apr. 25, 1936, pp. 257–259. General discussion of principles and procedure for national planning of development of water resources.

CONCRETE

Curing. Properties of Job-Cured Concrete at Early Ages, H. H. Edwards. *Am. Concrete Inst.—J.*, vol. 8, no. 1, Sept.–Oct., 1936, pp. 41–64. Report of Committee 107 of American Concrete Institute on relation between properties of job-cured concrete at early ages to control cylinders, laboratory-cured; effects of curing conditions, water-cement ratio, and aggregates; wall tests; effect of temperature at time of test; slab curing under different media; heat generated by cement hydration; highway concrete; controlling structural concrete by core test. Bibliography.

Railroad Structures, Masonry. Report of Committee VIII—Masonry. *Am. Ry. Eng. Assn.—Proc.*, vol. 37, 1936, pp. 631–654, 4 supp. plates. Specifications and principles of design of plain and reinforced concrete; recommendations for design in reinforced concrete of rigid-frame bridges without skew; progress in concrete manufacture; specifications for foundations, lining and relining tunnels; expansion joints involving masonry structures; specifications for overhead highway bridges.

Reinforcement. Study of Reinforcement in Concrete Slabs, I. Lyse and G. R. Wernisch. *Am. Concrete Inst.—J.*, vol. 8, no. 1, Sept.–Oct. 1936, pp. 1–16. Investigation of use of various types and grades of reinforcing steels in concrete slabs of various lengths, 4.0 in. thick (nominal effective depth 3.0 in.) and 34 in. wide in connection with various strengths of concrete; effect of size and spacing of reinforcement; initial cracking; effectiveness of type of reinforcement; effect of bar size on deflections; typical stress-strain curves for reinforcement.

CONSTRUCTION INDUSTRY

Costs. Current Construction Unit Prices. *Eng. News-Rec.*, vol. 117, no. 18, Oct. 29, 1936, p. 632. Unit costs bid on construction of 164,000 ft of lock-joint water-supply pipe line for Little Rock, Ark., Cape Cod canal revetments, and repairs to Braeburn Dam.

DAMS

Concrete Arch, Algeria. Barrage des Beni-Bahdel. *Travaux*, vol. 20, no. 40, Apr. 1936, pp. 157–159. Features of Beni-Bahdel multiple-arch reinforced-concrete dam in course of construction in Algeria; maximum height 47 m; length along crest 307 m; separate spillway is 180 m long.

Concrete Gravity, Washington. Economic Aspects of Grand Coulee, H. E. Riggs. *Elec. World*, vol. 106, no. 41, Oct. 10, 1936, pp. 39–41, 100, and 102. Discussion as to why Grand Coulee is being built; what need it will satisfy; whether it will be a self-supporting project; where its power will find a market; what it means to power industry; whether it is needed for irrigation and whether it is economically sound.

BAR-B-Q
BRIDGE AHEAD
BEING
RECONSTRUCTED

"Save the Structure" may well be the slogan of bridge engineers who, in 1937, are faced with the necessity of doing something about rapidly increasing live loads, great increases in traffic, and deteriorated roadway surfaces.

There is a direct solution in the use of Alcoa Aluminum to replace needlessly heavy floors and floor systems, railings and walk-ways.

Dead-load reduction with Alcoa Aluminum can add years of useful and safe service to thousands of existing bridge structures. Here are four things that may be accomplished: 1. Traffic capacity increased; 2. Permissible live load increased; 3. Roadway surface improved; 4. Stresses reduced.

Saving the structure with Alcoa Aluminum is good engineering, as several successful reconstruction jobs have proved. And it is good economics to avoid expensive new construction by a relatively small investment in sound improvement.

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Every square inch of rail steel reinforcement provides not less than 50,000 pounds of useful elastic strength which may be applied to design economy or safety or both. In the trend to high-elastic-limit materials this basic property of rail steel cannot be overlooked. Rail steel is specified by referring to A. S. T. M. Specification A 16-35 or to Federal Specification QQ-B-71. Detailed information may be obtained by writing the

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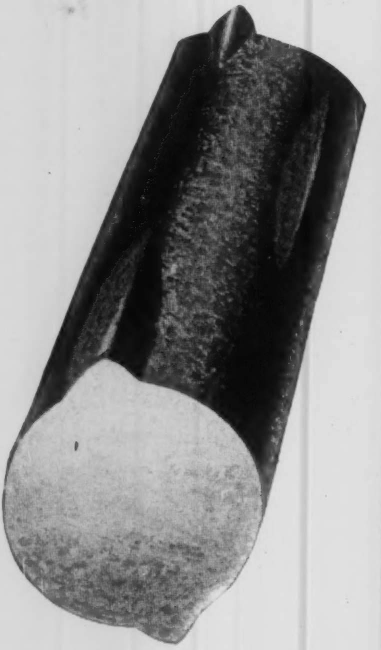


RAIL STEEL
for concrete
reinforcing

Earth, Facing. Second Steel-Faced Dam Built for Colorado Springs. *Eng. News-Rec.*, vol. 117, no. 18, Oct. 29, 1936, pp. 599–603. Design and construction of South Catamount Creek steel-faced earth-fill dam, for water supply of Colorado Springs, Colo., of 75-ft maximum height; facing of dam is combination of reinforced concrete slab and welded steel plates; investment costs; grouting of foundation; spillway capacity 1,200 cu ft per sec.

Earth, Hartford, Conn. Design of Bills Brook Dam, Barhamsted Reservoir, W. Dorenbaum. *New England Water Works Assn.—J.*, vol. 50, no. 3, Sept. 1936, pp. 302–314. Design and construction of concrete-core earth-fill dam, 157 ft maximum height, 1,950 ft long, for water works of Hartford, Conn.; model testing of spillway and diversion conduit; cost data.

Multiple Arch, Strengthening. Hodges Dam Strengthened, F. D. Pyle. *Eng. News-Rec.*, vol. 117, no. 19, Nov. 5, 1936, pp. 644–647. Cracks in thin concrete buttresses and need for rigidity to resist earthquakes led to reinforcement of 130-ft multiple-arch dam of San Diego water system, 18 years old, by building rigid vertical frames on alternate bays; construction methods; chipped surfaces and keyways used to bond old and new concrete; details of vertical frames.

Rock Fill, China. Steep Concrete Face on Rock-Fill Dam in China. *Eng. News-Rec.*, vol. 117, no. 20, Nov. 12, 1936, pp. 677–679. Design and construction of rock-fill dam, 275 ft maximum height, 695 ft long, on Shing Mun River near Kowloon, China; dam consists of thin reinforced-concrete upstream face, backed with low-grade concrete thrust block, sand wedge, and mass of rock fill; cutoff wall; thrust block design; sand wedge distributes pressure.

Weirs, Uplift. Uplift Pressure on Weirs, V. I. Vaidhianathan, G. Ram, and E. M. Taylor, *Indian Academy Sciences—Proc.*, vol. 2, no. 6, Dec. 1935, pp. 646–655. Hydraulic model studies of flush floor with different lengths of sheet pile at upstream end, and of depressed floor with different lengths of sheet pile at upstream end. Bibliography.

FLOOD CONTROL

Levees, China. Yao Dike on Han River, T. C. Hsi. *Assn. Chinese & Am. Engrs.—J.*, vol. 17, no. 5, Sept.–Oct., 1936, pp. 293–297, 4 supp. sheets. Construction, by primitive methods, of dike involving nearly 7,000,000 cu m of earth and working on length of 18 km within about 150 days. (In English.)

United States. March 1936, Floods in New England. *Boston Soc. Civ. Engrs.—J.*, vol. 23, no. 4, Oct. 1936, pp. 286–316. Symposium consisting of following papers: Flood Flows in New England During March 1936, Flood, H. B. Kinnison; Merrimack River at Lowell, A. T. Safford; Francis Gate, at Lowell, S. S. Kent; Merrimack River Dams in New Hampshire and 1936 Flood, R. S. Holmgren; Some Experiences in New England Power Association Territory During Flood of 1936, H. M. Nelson; March 1936, Flood at Holyoke, Mass., A. W. Ladd.

Vermont. Spring Floods Test Winooski Flood-Control System, C. D. Curran. *Eng. News-Rec.*, vol. 117, no. 15, Oct. 8, 1936, pp. 510–513. Two completed flood-control dams on the Winooski River in Vermont, begun after the flood of 1927, show possibilities of projected seven dams in the flood of March 1936.

FLOW OF FLUIDS

Weirs, Discharge. Sutro Weir Investigations Furnish Discharge Coefficients, E. Soucek, H. E. Howe, and F. T. Mavis. *Eng. News-Rec.*, vol. 117, no. 20, Nov. 12, 1936, pp. 679-680. Tests of eleven Sutro proportional flow weirs, recently completed at Iowa Institute of Hydraulic Research, indicating close relationship between coefficient of discharge and geometrical proportions of weir; relationship is shown in form of nomographic chart; theory and use of weir.

FOUNDATIONS

Strip Mills. 14,500 Steel H-Piles Support $20,000,000 Strip Mill. *Construction Methods*, vol. 18, no. 2, Feb. 1936, pp. 28–32. Driving of 14,500 H-section steel piles for foundations of heavy industrial buildings and mill machinery of the Bethlehem Steel Company's Lackawanna plant at Buffalo, N. Y.; piles 10 in. wide and 14 to 48 ft long; results of load-bearing tests.

HYDRAULIC ENGINEERING

Laboratories, Recent Work. American Hydraulic-Laboratory Practice, L. J. Hooper. *Am. Soc. Mech. Engrs.—Trans.*, vol. 58, no. 7, Oct. 1936, pp. 577–588 (HYD-58–53). Brief description of representative laboratories and their work in recent years. Bibliography.

Recent Progress. Dams, Pipe Lines, and Pumping, S. B. Morris. *Am. Water Works Assn.—J.*, vol. 28, no. 10, Oct. 1936, pp. 1604–1616. Brief review of contributions recently made to engineering knowledge in these fields; coordinated planning for complete river utilization; special cements and concrete placing; design and stress analysis; hydraulic models; construction plant and methods; concrete pipe; deep-well pumps; Colorado River aqueduct pumps.

Tides, Models. Rangoon Tidal Model. *Engineer*, vol. 162, no. 4210, Sept. 18, 1936, pp. 294–297; see also editorial comment, p. 291. Description of model with which exhaustive experiments were made and summary of two principal reports made by engineers; proof of accuracy; investigation of origin of silt on outer bar; bank erosion; conclusions from proof experiments; probable effect of artificial works; dredging.

HYDROELECTRIC POWER PLANTS

Soviet Union. Svirstroy, Leningrad, 1935. 599 pp., figs., diagrs., charts, tables. Symposium in six issues describing design and construction of combined navigation and hydroelectric power project on Svir River near Leningrad, U.S.S.R., producing over 1,000,000 kwh daily. (In Russian, with brief English abstracts of papers.)

HYDROLOGY AND METEOROLOGY

Beaches, Germany. Die Wanderung der Sandriffe vor den ostfriesischen Inseln, Gaye and Walther. *Bautechnik*, vol. 13, no. 41, Sept. 24, 1935, pp. 555–567. Historical study of wandering of sand ridges on East-Friesian Island on north coast of Germany since 1600; analysis of causes and nature of these wanderings and their effect on topography of beaches.

Cyclones. Advances and Developments in Weather Forecasting, R. H. Weightman. *Franklin Inst.—J.*, vol. 222, no. 5, Nov. 1936, pp. 527–549. Notes of surface cyclones and anti-cyclones; vertical structure of cyclones and anti-cyclones; kinematical methods.

INLAND WATERWAYS

Rivers, Hydraulics. Modellversuche ueber das Verhalten eines schwemmstoffuehrenden Flusses, etc., C. Keutner. *Bautechnik*, vol. 14, no. 6, Feb. 4, 1936, pp. 98–108. Munich Hydraulic Laboratory tests of models of straight and winding courses of silt-carrying rivers having stable normal bed; problem was to determine flood-stage behavior of Hwangho River in China; silt analysis; determination of effect of distance between levees on flood régime of river.

Rivers, Improvement. Die Bauten der Neckarkanalisierung, Konz. *Zentralblatt der Bauverwaltung*, vol. 56, no. 11, Mar. 11, 1936, pp. 229–239. Features of movable dams, locks, power plants, and dredges of canalized portion of Neckar River, Germany.

Rivers, Regulation. Il nuovo sostegno regolatore presso Padova, fondato con cassoni autofondanti "Kofler," U. Lunghini. *Annali dei Lavori Pubblici*, vol. 74, no. 8, Aug. 1936, pp. 641–645. Construction of regulating concrete dam for improvement of navigation conditions of Bacchiglione River, near Padua, Italy, founded on patented, self-sinking, Kofler, concrete caissons.

IRRIGATION

Surge Tanks. Better Appearance Sought in Steel Surge Tank. *Eng. News-Rec.*, vol. 117, no. 17, Oct. 22, 1936, pp. 582–583. Design of tank and tower on Platte Valley power and irrigation project in Nebraska, using special column and balcony railing; tank is of hemispherical bottom type, has nominal capacity of 910,000 gal, is 46 ft in diameter and 57 1/2 ft high.

LAND RECLAMATION AND DRAINAGE

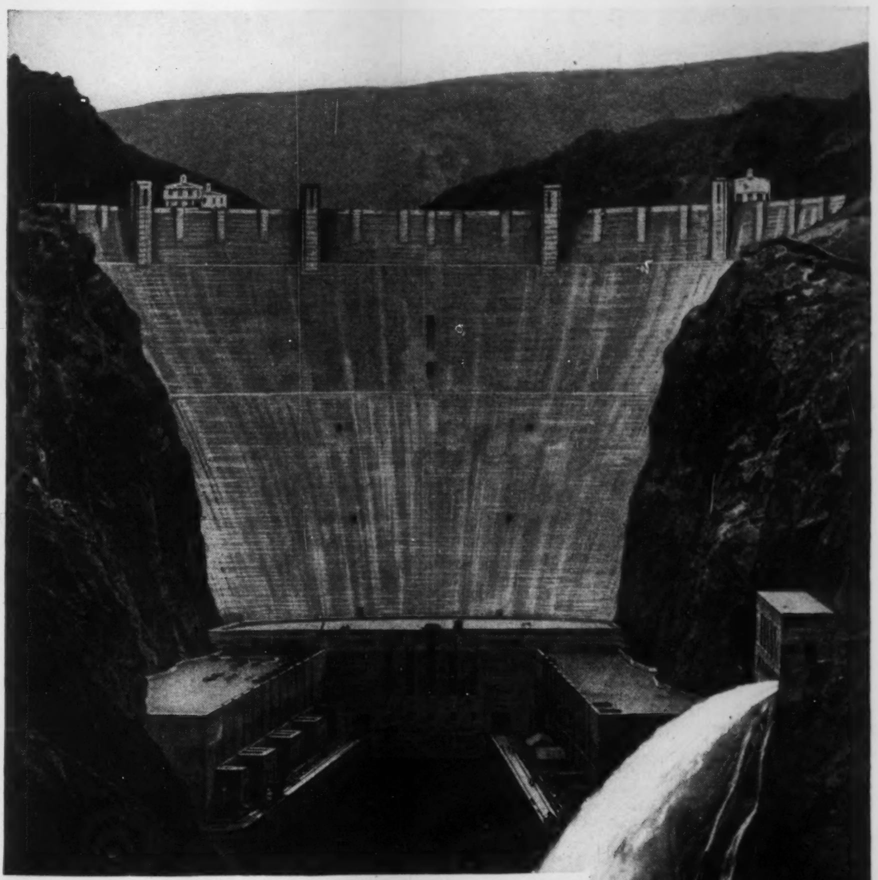
Germany. Der Adolf Hitler-Koog, Lorenzen and Pakusa. *Zentralblatt der Bauverwaltung*, vol. 55, no. 39, Sept. 25, 1935, pp. 761–772. Construction of dike 9.3 km long, also canals, sluices, and harbors for reclaiming area of 1,333 ha of agricultural land on North Sea coast of Schleswig-Holstein in Germany; features of water supply system including pumping station.

New York World's Fair. Ash Fill Converts Swamp into Grounds for World's Fair. *Eng. News-Rec.*, vol. 117, no. 17, Oct. 22, 1936, pp. 565–568. Ashes and rubbish of Brooklyn and Queens, deposited in tidewater swampland adjoining Flushing Bay in Queens, is being cut down and spread over 780 acreas of swamp as first stage of development of site for New York World's Fair, to be held in 1939; grading operations; distribution of 6 1/2 million cu yd of refuse and one million yards of wet excavation; equipment service; floodlighting system for night work.

400,000 POUNDS

–AND THEY CALL IT A "Butterfly"

That's the scale they do things on at Boulder Dam



Of course, it's not just *size* that counts, when you're deciding what metal to use to carry out the design for a job like the butterfly valves at Boulder Dam. Every ounce of metal used had to have the stamina to withstand the onset of tons of water for a generation or longer.

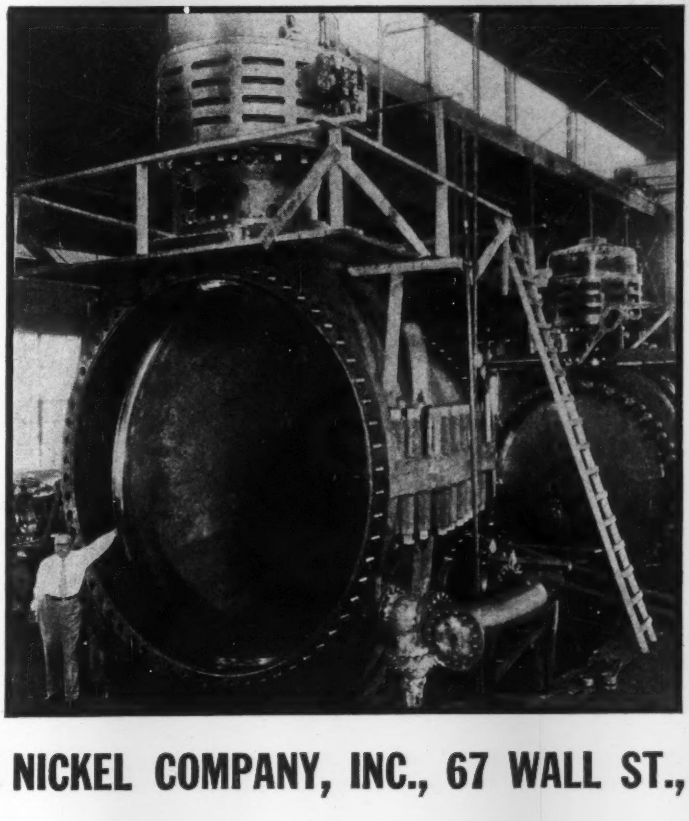
But size does matter—in more ways than one. It's more difficult to keep uniformity of grain texture, to hold the vital toughness, when your castings are 168 inches diameter, like this one. And think of the enormous cost of repairs and replacements . . . the engineers had to choose metals that would need none for years.

To assure these results, six 168-inch valves like this one were specified of a Nickel Alloy Steel, cast to this composition:

Carbon	0.25 – 0.35%
Manganese	1.00% max.
Silicon	0.40%
Nickel	1.00 – 1.50%

With this analysis, the valves show a minimum tensile strength of 75,000 p.s.i., and a yield point of 50,000 p.s.i.

Main holding bolts require somewhat different properties, which Boulder Dam's engineers supplied with S.A.E. 2340, a 3½% Nickel Steel. Let the Inco engineers apply their wide experience to help you find the best type of Nickel Alloy Steel to fit your particular needs.



- One of six 168-inch butterfly valves for Boulder Dam, weight 400,000 pounds. These were made by Hardie-Tynes Mfg. Co., with Nickel Steel Castings containing 1 to 1.50% Nickel supplied by the Erie Forge Co.

NICKEL ALLOY STEEL

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MATERIALS TESTING

Beams, Concrete. Stresses in Shear Reinforcement of Reinforced Concrete Beams, R. H. Evans and J. Thomlinson. *Engineering*, vol. 142, no. 3687, Sept. 11, 1936, pp. 269–271. Tests carried out on 16 beams under prolonged loadings, beams being provided with different types or combinations of shear reinforcement; method of determining stress in reinforcement was to expose steel at two points and to measure strain on surface of steel by means of 2-in. roller extensometers using suitable optical magnification.

Concrete, Shrinkage. Das Verhalten von Betonkoerpern bei verschiedenen Lagerungsbedingungen, etc., H. Kayser and G. Rueth. *Beton u. Eisen*, vol. 35, no. 10, May 20, 1936, pp. 169–175. Report from engineering laboratory of Darmstadt Institute of Technology on effect of various storage conditions on shrinkage of concrete test specimens of various compositions.

PORTS AND MARITIME STRUCTURES

Beaches, Preservation. Preservation of Sea Beaches, H. J. Deane and E. Latham. *Engineering*, vol. 142, nos. 3689 and 3690, Sept. 25, 1936, pp. 329–331, 338 (discussion), 342, and Oct. 2, pp. 377–378. Discussion of problem of retaining beach material at requisite levels; detrimental effects of extensive systems of groining; construction of moles, piers, and entrance jetties to harbors; excerpts quoted from by-laws of Catchment Boards dealing with removal of beach material; important examples dealt with. Before Brit. Assn.

Foundations. Precast Concrete Cylinders Support New Wharf. *Eng. News-Rec.*, vol. 117, no. 17, Oct. 22, 1936, pp. 569–573. Unusual combination of concrete cylinders, 9 ft in diameter and from 55 to 70 ft long, and timber piling used in reconstruction of berths at Saint John Harbor, N.B.; substructure of wharf consists of transverse bents, 20 ft center to center, made up of two cylinders and two pile clusters; cylinders cast in drydock· caisson sinking; ground movement; low-tide operations; bulkhead construction troubles; work to cost $2,750,000.

Puerto Rico. Puerto Rico, Rich Port of Spanish Main, G. W. Grupp. *Naut. Gaz.*, vol. 126, no. 20, Sept. 26, 1936, pp. 6–9, 18–19, and 31–32. Brief historical review; geographic location; topography; climate; people; resources and industries; advertising and selling; internal and external transport facilities; ports and shipping facilities; government regulations; trade opportunities.

Quay Walls, Netherlands. Die Entwicklung der Kaimauerbauten im Hafen von Rotterdam. *Bautechnik*, vol. 14, no. 7, Feb. 7, 1936, pp. 115–118. Evolution of quay-wall construction in port of Rotterdam, Netherlands, since 1871; structural features of quay walls.

ROADS AND STREETS

Brick, Methods. Modern Brick Paving Practice, R. L. Phillips. *Eng. News-Rec.*, vol. 117, no. 13, Sept. 24, 1936, pp. 435–437. Résumé of method and procedure that have been developed by research and standardized by practice, emphasizing stabilized subgrades, smooth bases, thin cushions, de-aired brick, and bituminous fillers; standard sizes and types of paving brick; relaying and resurfacing.

Embankments. Hydro-Erdbauverfahren beim Bau von Autobahn- und Erddaemme Zill. *Bautechnik*, vol. 13, no. 46, Oct. 25, 1936, pp. 627–629. Discussion of recent German experience with hydraulic construction of roadway and earth embankments; theory of process.

Highway Accident Prevention. Die Haftung fuer Verkehrsunfaelle auf den Reichsautobahnen, W. Weigelt. *Verkehrstechnik*, vol. 17, no. 18, Sept. 20, 1936, pp. 469–471. Review of German traffic rules for prevention of automobile accidents on new system of German superhighways.

Highway Systems, Mexico. Nuevo Laredo-Mexico City Highway, R. B. Brooks. *Eng. News-Rec.*, vol. 117, no. 15, Oct. 8, 1936, p. 521. Description of recently opened 770-mile stretch of highway from Texas border to capital of Mexico; new section, built at cost of about $17,000,000, is of oil-treated macadam and gravel construction, with paved surface 19 ft 7 in. wide.

Salt Stabilization. Common Salt in Highway Construction and Maintenance, C. A. Robbins. *Can. Min. & Met. Bul.*, no. 291, July 1936, pp. 284–288. Uses of salt discussed are in stabilization of loose, floating top surfaces and in ice control; selection of suitable materials; construction procedure; maintenance; treatment of icy roads extensively practiced in winter maintenance of highways in Ontario.

SEWERAGE AND SEWAGE DISPOSAL

Activated Sludge. Operating Activated Sludge Plant to Prevent Sludge Bulking, C. G. Anderson. *Water Works & Sewerage*, vol. 83, no. 9, Sept. 1936, pp. 342–344. Elimination of sludge bulking at Rockville Center, Long Island, plant by determining concentration of sludge that can be carried in mixed liquor without depletion of dissolved oxygen. Before N. Y. State Sewerage Works Assn.

Filters, Trickling. Aero-Filtration of Sewage and Industrial Wastes, H. O. Halvorson. *Water Works & Sewerage*, vol. 83, no. 9, Sept. 1936, pp. 307–313. Review of current practice in design of sewage trickling filters; results of experimental work at Minneapolis to study factors responsible for flow of air through filter and to determine means of controlling growth of Fusariae.

Plants, Denver, Colo. Sewage Treatment for Denver. *Eng. News-Rec.*, vol. 117, no. 16, Oct. 16, 1936, pp. 535–539. Description of disposal plant with capacity of 54 mgd, including pre-aeration, chemical treatment, filtration by means of rectangular down-flow, magnetite units and separate sludge digestion; additional dilution water to be supplied to stream receiving plant effluent; construction cost analysis.

Plants, Flow Meters. Venturi Flumes for Sewers, H. K. Palmer. *Water Works & Sewerage*, vol. 83, no. 9, Sept. 1936, pp. 322–324. Explanation of method used successfully in Los Angeles County, California, since 1933; design of Venturi type flume; formulas, rating curves, and accuracy.

Plants, Germany. Ausbau der Vorklaeranlage Wassmannsdorf zu einem biologischen Klaerwerk, A. Reisser. *Gesundheits-Ingenieur*, vol. 59, no. 18, May 2, 1936, pp. 249–259. Converting old Wassmannsdorf sewage disposal plant near Berlin, Germany, into modern activated sludge plant at cost of nearly 3,000,000 reichmarks; details of sewage tanks, pumping, and aeration equipment; cost data.

Plants, Williamsburg, Va. Operation of New Sewage Treatment Plant at Williamsburg, Va., A. L. Meisel. *Water Works & Sewerage*, vol. 83, no. 9, Sept. 1936, pp. 352–353. Results obtained from plant of separate digestion-sprinkling filter type with capacity of 750,000 gal per day of domestic sewage. Before Va. Sewage Works Assn. and Am. Water Works Assn.

Sewers, Inspection. Six-Mile Trip by Boat Through Old Sewer. *Eng. News-Rec.*, vol. 117, no. 11, Sept. 10, 1936, pp. 379–380. Description of specially designed boat used in inspecting outfall sewer, $10^{1}/_{2}$ ft high, 12.25 ft wide, and 6 miles long, at Los Angeles; equipment included radio telephone, oxygen helmet, searchlight, and camera.

Tanks. Study of Rational Design of Settling Tanks, T. R. Camp. *Sewage Works J.*, vol. 8, no. 5, Sept. 1936, pp. 742–758. Factors influencing clarification by sedimentation; settling velocities of individual particles; clarification theory for ideal, continuous-flow, rectangular basin; experimental tank studies; factors influencing tank stability; relations of stability to hydraulic characteristics. Before Soc. Promotion Eng. Education.

STRUCTURAL ENGINEERING

Masonry Structures, Disintegration. Schaeden an massiven Bauwerken und ihre Behebung, Leopold. *Bautechnik*, vol. 14, no. 6, Feb. 4, 1936, pp. 88–97. German experience with disintegration of masonry-arch bridges, culverts, and similar structures, and its prevention.

TUNNELS

Vehicular. Tunnels Reduce Slide Hazard on Cliffside Road. *Eng. News-Rec.*, vol. 17, no. 18, Oct. 29, 1936, pp. 605–606. Construction of tunnels under scaling, unstable cliffs of new Cliffside road in Feather River canyon, between Oroville and Quincy, Calif., for prevention of damage from rockfalls.

Water Supply, Concrete Lining. New Method of Lining Tunnels. *Engineer*, vol. 162, no. 4210, Sept. 18, 1936, p. 300. Method evolved by B. L. Hamilton of Auckland, New Zealand, water works department, put into operation on Waitakere pipe line; it is likely that new method will be used extensively in places where soil will stay unsupported for few hours; platform on which arches are conveyed to tunnel is described.

Water Supply, Methods. $58,000,000 for a 20-Mile Distribution Tunnel. *Water Works Eng.*, vol. 89, no. 19, Sept. 16, 1936, pp. 1206–1211. Method of constructing 17-ft City Tunnel No. 2 for New York City at varying depths of 361 to 766 ft.

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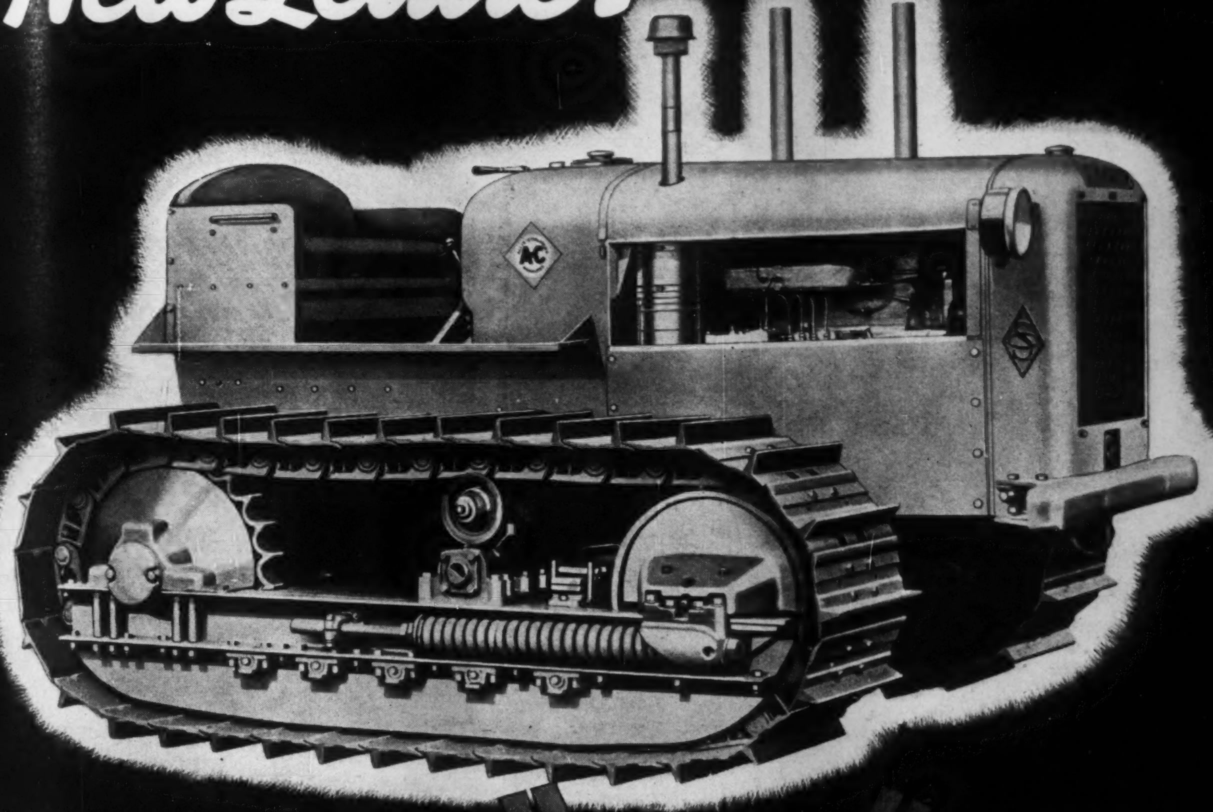

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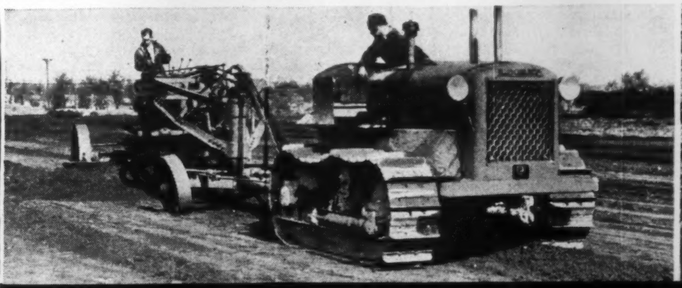

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WATER PIPE LINES

MAINTENANCE AND REPAIR, CLEANING. Salvaging a 40-Year-Old, 48-Inch Steel Force Main, S. H. Taylor and G. C. Linberg. *Water Works Eng.*, vol. 89, no. 19, Sept. 16, 1936, pp. 1222, 1225–1226, and 1229. Methods used at New Bedford, Mass., to clean inside of steel pipe line, 48 in. in diameter and 8 miles long, and to line it with steel mesh reinforcement and $1^1/_4$ in. of gunite cement.

WATER RESOURCES

CHINA. Shansi Water and Power Problems O. J. Todd. *Assn. Chinese & Am. Engrs.—J.*, vol. 16, no. 4, July-Aug. 1935, pp. 205–225, 4 supp. sheets. Report on projected development of water resources of Shansi Province; problems of Fen Ho; Yellow River power project; plan of development; other power projects in Shansi; irrigation schemes for southwest Shansi; lesser rivers of Shansi; river characteristics. (In English.)

UNDERGROUND, NORTH CAROLINA. Geology and Ground-Water Resources of Elizabeth City Area, North Carolina, S. W. Lohman. *U. S. Geol. Survey—Water-Supply Paper 773-A*, 1936, 57 pp., 4 supp. sheets. Price 10 cents. Surface features; climate; geology; water-bearing beds; contamination by salt water; well tables; analyses of surface water.

UNDERGROUND, PROSPECTING. Geophysical Prospecting for Underground Waters in Desert Areas, F. W. Lee. *U. S. Bur. Mines—Information Cir., 6899*, Aug. 1936, 27 pp., 18 supp. sheets. Geophysical prospecting for water in Nevada and adjacent states; field technique and geologic interpretations; measuring earth resistivity directly for correlating geological structure; field measurements for water; well-drilling machines for drought relief; electric resistivity measurements on artesian wells; camp preparations and equipment. Bibliography. Appendix on divining rod.

UNDERGROUND, SPREADING. Artificial Storing of Ground Water by Spreading, D. A. Lane. *Am. Water Works Assn.—J.*, vol. 28, no. 9, Sept. 1936, pp. 1240–1251. Review of California methods of artificial application of water upon ground surface in such manner as to allow water to sink into and become part of underlying ground-water body; furrow or ditch method, basin method, walls and shafts, and stream-channel spreading; unit rates of percolation; experimental work.

WATER TREATMENT

ANALYSIS, BORON DETERMINATION. Methods of Testing and Significance of Boron in Water, R. L. Derby. *Am. Water Works Assn.—J.*, vol. 28, no. 10, Oct. 1936, pp. 1449–1455. Remedial measures for high boron content of water; boron in Los Angeles water supply. Bibliography.

FILTRATION PLANTS, DESIGN. Filter Design as Related to Operation, H. N. Jenks. *Am. Water Works Assn.—J.*, vol. 28, no. 10, Oct. 1936, pp. 1541–1550. Filter design; filter structure and equipment; filter control equipment; filter operation; normal operation as influenced by design; operating difficulties that may be anticipated in design.

FILTRATION PLANTS, MAINTENANCE AND REPAIR. Maintenance of Filter Plant Equipment, J. L. Perhab. *Am. Water Works Assn.—J.*, vol. 28, no. 10, Oct. 1936, pp. 1571–1576. Routine of water purification plant of Beverly Hills, Calif., in maintenance of electrical equipment, chemical feeders, clarifiers and mixing machines, chlorinators and ammoniators, CO_2 generators, Venturi meter, loss of head and rate of flow recorders, rate of flow controllers, and pumps.

FILTRATION PLANTS, OAKLAND, CALIF. Orinda Filtration Plant of East Bay Municipal Utility District, Oakland, California, J. D. DeCosta. *Am. Water Works Assn.—J.*, vol. 28, no. 10, Oct. 1936, pp. 1551–1570. History, design, and construction of new water-treatment plant with present capacity of 42 mgd, serving population of 500,000; hydraulic data; administration and filter buildings; filters; washwater tank; analysis of operating costs; chemical analyses.

FILTRATION PLANTS, OPERATION. Raw-Water Preparation vs. Filter Design, M. C. Smith. *Water Works & Sewerage*, vol. 83, no. 9, Sept. 1936, pp. 350–351. Experiences at Richmond, Va., regarding filterability factor, sand sizes, methods of filter operation, and hazards of predicting plant performance based on results from experimental glass tube filters.

ODOR REMOVAL. Odor-Elimination Treatments and Their Effectiveness, O. Gullans. *Am. City*, vol. 51, no. 10, Oct. 1936, pp. 48–50. Procedure for conducting odor test; comparison of odor elimination treatments. Before Am. Water Works Assn.

PLANKTON. Plankton and Insect Larvae Control in California Waters, G. E. Arnold. *Am. Water Works Assn.—J.*, vol. 28, no. 10, Oct. 1936, pp. 1469–1479. Review of California experience with plankton growths; method used at San Francisco; insect larvae; chironomous mosquitoes, gnats, flies, and crustacea. Bibliography.

PLANTS, FLOATING. Floating Water Treatment Plant. *Engineer*, vol. 162, no. 4212, Oct. 2, 1936, p. 356; see also *Engineering*, vol. 142, no. 3693, Oct. 23, 1936, p. 444. Unusual type of craft built by Thornycroft to order of United Water Softeners, Ltd.; to be used by Metropolitan Water Board on certain of its reservoirs; boat was 20 ft in length, with beam of 7 ft; boat was propelled by Thornycroft 12-hp, 4-cylinder engine.

POLLUTION, ANALYSIS. Microscopic Methods Used in Biological Investigation of Lake and Stream Pollution, and Interpretation of Results, T. A. Olson. *Sewage Works J.*, vol. 8, no. 5, Sept. 1936, pp. 759–765. Examinations involving study of planktones, aquatic insect larvae, Oligochaete worms, leeches, etc. Bibliography.

POLLUTION, NEW HAMPSHIRE. Public Waters Pollution Control in New Hampshire, C. D. Howard. *New England Water Works Assn.—J.*, vol. 50, no. 3, Sept. 1936, pp. 334–339. Review of legislative and administrative work of State of New Hampshire, since 1885. Before New Hampshire Academy of Science.

SAND, PERMEABILITY. Study of Permeability of Sand, F. T. Mavis and E. F. Wilsey. *Univ. Iowa Studies—Studies in Eng.—Bul.*, no. 7, Feb. 1, 1936, 29 pp. Results of study of tests made on unigranular sands and on blended samples with view to determining effect upon permeability of water temperature, size and shape of grain, porosity, and mechanical analysis of sand samples; formulas proposed on basis of tests and comparisons made with other formulas for flow of water through sands. Bibliography.

TASTE AND ODOR REMOVAL. Evaluating Treatments for Eliminating Taste and Odor, O. Gullans. *Water Works & Sewerage*, vol. 83, no. 9, Sept. 1936, pp. 347–349. Improved method for sensitive odor test on water; basis for comparison of odor elimination treatments; procedures for making tests for comparison of powdered activated carbon, superchlorination and dechlorination, ozone, ammonium, chlorine and aeration treatments. Before Am. Water Works Assn.

WATER WORKS ENGINEERING

BUFFALO, N.Y. Extensive Improvements Aid Buffalo Water System. *Eng. News-Rec.*, vol. 117, no. 18, Oct. 29, 1936, pp. 615–616. Improvements involving erection of three shallow elevated tanks with capacity of 2,000,000 gal; installation of three electrically driven pumps for high-pressure fire system with capacity of 3,000 gal per min; construction of addition to Clearwater reservoir at filtration plant; and construction of 10,500 ft of 36-in. main trunk feeder loop.

DISTRIBUTION SYSTEMS. Past Year in Distribution Field, W. W. Brush. *Am. Water Works Assn.—J.*, vol. 28, no. 10, Oct. 1936, pp. 1617–1620. Review of recent progress; features of 17-ft tunnel for New York, distribution pipe, valves, control devices for elevated tanks, and meter tests.

HONG KONG. Water Supply of Hong Kong. C. A. M. Smith. Pt. I—Works on Island, *Water & Water Eng.*, vol. 38, no. 468, Sept. 1936, pp. 489–494. History and description of water works system serving population of about 1,000,000; features of dams and reservoirs.

IRRIGATION. Dual Usage of Water for Domestic and Irrigation Purposes, J. B. Lippincott. *Am. Water Works Assn.—J.*, vol. 28, no. 9, Sept. 1936, pp. 1232–1239. Discussion of dual function of Owens Valley Aqueduct of Los Angeles Water Works and of Los Angeles Metropolitan Water District in supplying water for both domestic and irrigation purposes.

SYDNEY, NEW SOUTH WALES. Water Supply of Sydney, New South Wales, J. M. Antill. *Water & Water Eng.*, vol. 38, no. 467, Aug. 1936, pp. 466–469. History and description of system, including several dams, supplying 86 mgd.

WELLS, RADIAL. London Water Supply Augmented by New Underground System, R. Nebolsine. *Eng. News-Rec.*, vol. 117, no. 17, Oct. 22, 1936, pp. 576–577. Additions to water works of London, including radial well collector installation, 12.5 ft in diameter, used to supplement London supply during dry season; improved technique in driving pipe screens horizontally facilitates large draft on subsurface water basin.

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The San Francisco–Oakland Bay Bridge

THE FINEST and most interesting piece of printed literature which has been received in quite some time is the 96-page brochure on the San Francisco–Oakland Bay Bridge which was recently published by the American Bridge Company, Pittsburgh, Pa.

Its large page size, $8^1/_2$ by 11, permits the generous use of clear and instructive photographs. In themselves, these illustrations practically compose a progress of work record.

The introduction covers the historical background from the inception of the idea for a bridge; touches on the geography, population and traffic of the bay section; and lists the bridge plans, specifications and contracts. Other sections describe in detail the West Bay Crossing, Yerba Buena Tunnel, and the East Bay Crossing; the substructure of both crossings; the suspension bridge towers; the suspension bridge cables; the suspension bridge trusses and floor; the East Bay Crossing; materials; and roadway pavement. The short conclusion is followed by an appendix listing the organizations participating in the design and construction of the project; the materials and services furnished by the subsidiaries of the United States Steel Corporation; dimensions; quantities; outstanding features and comparisons.

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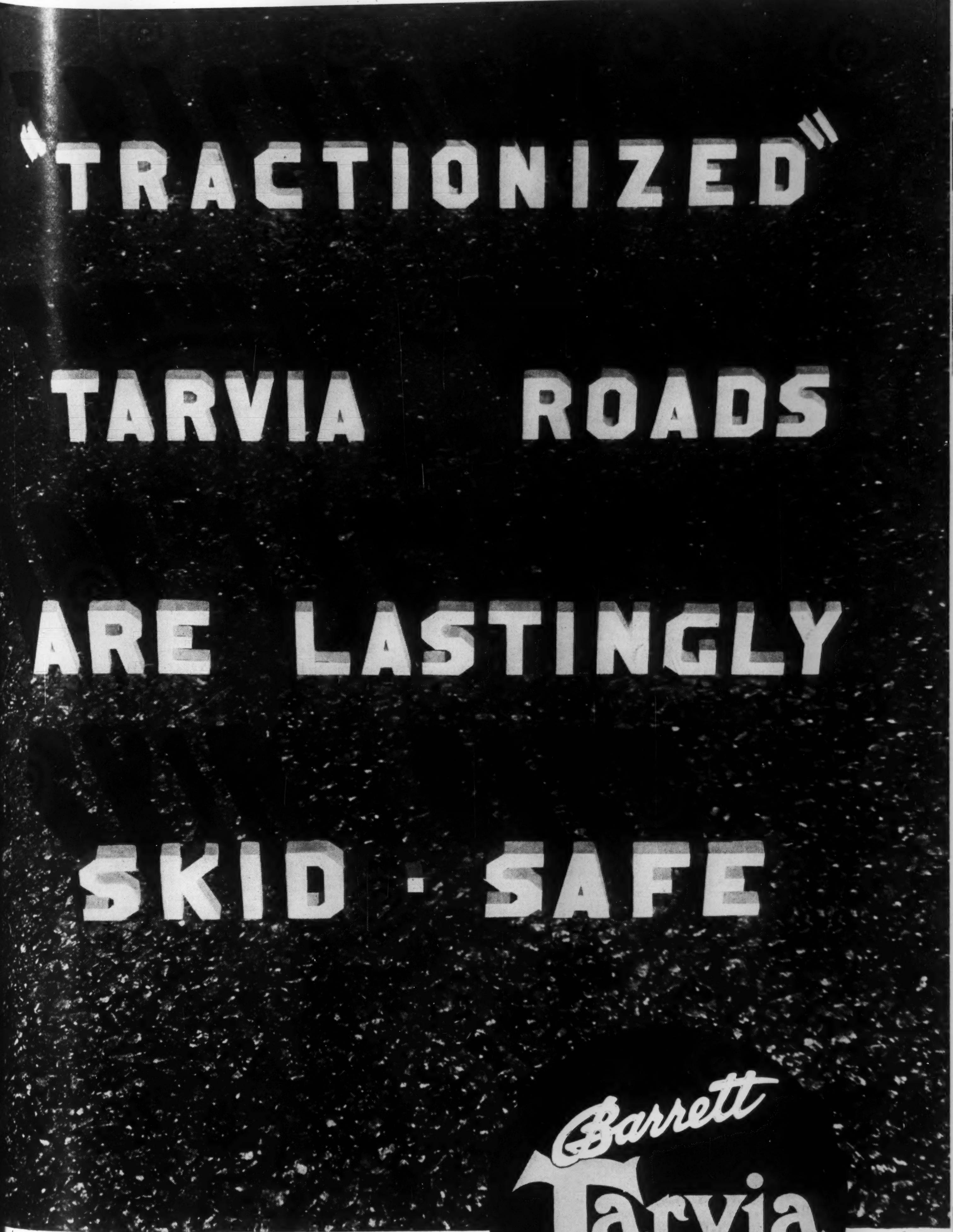
A NEW booklet describing the solution to scores of actual metal problems as encountered by the engineer has just been issued by The International Nickel Company. Containing 48 pages, illustrated throughout, this booklet has been prepared primarily as a guide book to Monel and other non-ferrous nickel alloys in the fields of engineering applications. It also covers the corrosion resistance and other properties of these metals.

The booklet includes 20 sub-divisions, each devoted to specific problems in fields from hydroelectric and steam power plants to highway maintenance, refrigeration, and automobiles. Besides going into details of standard Monel the booklet describes some of the newer forms of this alloy, including "K" Monel, "S" Monel and the like. The non-magnetic forms of the metal are also covered in a special section devoted to airplanes and the like. Inconel, the high nickel-chromium alloy, is another subject covered. Special items included are those dealing with meters and other regulating equipment, sewage disposal, pump maintenance, and other items of general interest.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BRIDGES

Floors. Asphalt Plank Pavement Bridge Floor, E. R. Needles. *Am. City*, vol. 51, no. 11, Nov. 1936, pp. 39–41. Results of detailed analysis of various types of floor materials to find suitable light-weight product for lift spans of Triborough Bridge, New York City.

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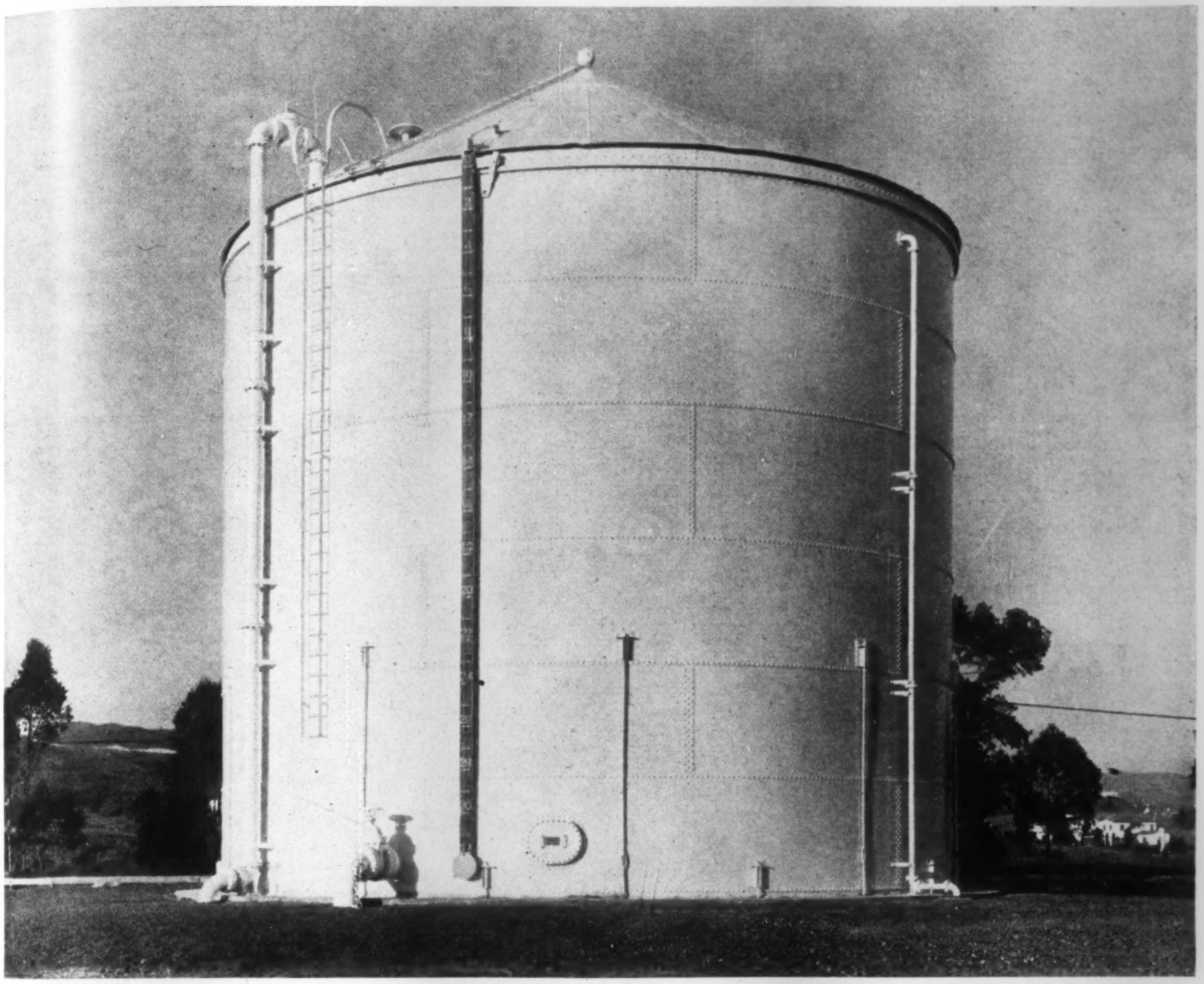

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Plants in BIRMINGHAM, CHICAGO and GREENVILLE, PENNA.

PORTS AND MARITIME STRUCTURES

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Asphalt. Sound Asphalt Road Mix Made with Ordinary Concrete Sand, F. S. Besson. *Eng. News-Rec.*, vol. 117, no. 16, Oct. 15, 1936, pp. 539–541. Experience of District of Columbia leading to conclusion that sands suitable for cement concrete make stable mix for pavement by proportioning bitumen filler to suit voids in sand.

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SEWERAGE AND SEWAGE DISPOSAL

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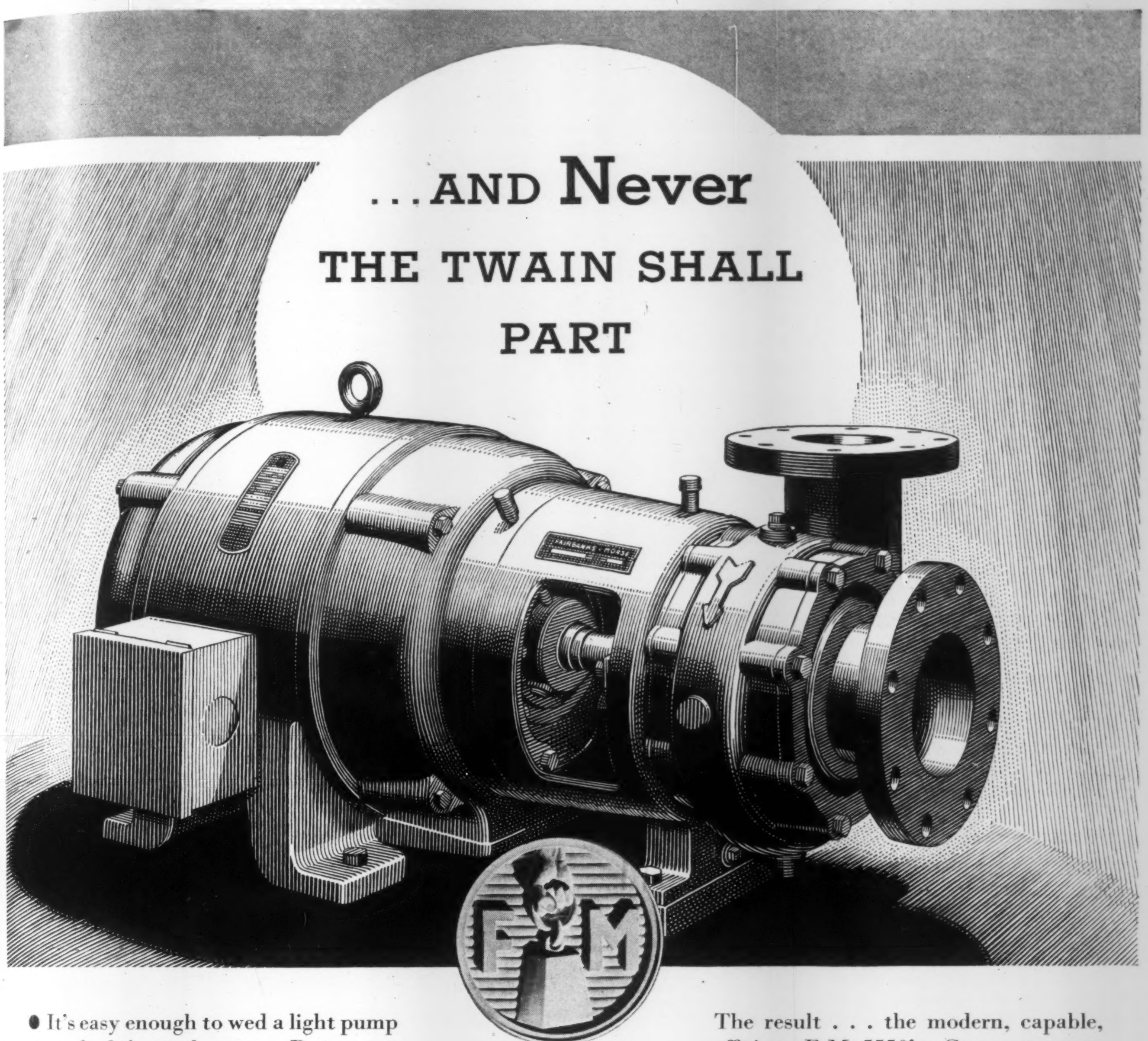

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SEWER TUNNELS, CHICAGO. Chicago's Sewer Tunnels. *Eng. News-Rec.*, vol. 117, no. 21, Nov. 19, 1936, pp. 703–708. Construction of southwest intercepting sewer, 12.4 miles long, designed for maximum storm flow of over 600 mgd; tunneling procedure; concrete lining; concrete specifications; concrete handling; concreting in compressed air; hand labor judiciously used; safety regulations; unusual cofferdam.

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SLUDGE DIGESTION. Operation of Separate Sludge Digestion Plants, W. W. Towne. *Pub. Works*, vol. 67, no. 10, Oct. 1936, pp. 9–10. Purpose of mechanically cleaned settling tank and separate sludge digestion tank; efficient operation of such unit demonstrated by experience with plant at Grand Rapids, Mich.

STRUCTURAL ENGINEERING

DOMES, CAST IRON. Monument to Cast Iron, L. W. Allison. *Iron Age*, vol. 138, no. 21, Nov. 19, 1936, pp. 44–45, and 122. Design of dome of U. S. Capitol building in Washington, D.C., built from 1856 to 1865 of cast-iron members weighing 4,500 tons.

EARTHQUAKE EFFECT. Earthquake Movements and Engineering Structures, G. G. Narke. *Bombay Eng. Congress—Min. Proc.*, 1935, vol. 24, paper no. 160, 1936, 11 pp., (discussion) 10–11, 5 supp. sheets. Dynamic agents at work on surface of globe; interior of earth; earthquake waves; short descriptions of Bihar and Quetta earthquakes; seismic zones of Indian Empire and their origins; effects of earthquakes on structures; precautions to be observed by engineers engaged in erection of structures in earthquake areas.

PLATES, DESIGN. Calcul des plaques rectangulaires fléchies par les séries simples, F. Keelhoff. *Annales des Travaux Publics de Belgique*, vol. 37, no. 3, June 1936, pp. 291–316. Analysis of stresses in simply supported and in partly or totally fixed rectangular plates subjected to bending.

TUNNELS

SUBAQUEOUS. Engineer Describes Under-Water Tunnel Construction, L. S. Stiles. *Gen. Contractors Assn.—Bul.*, vol. 27, no. 11, Nov. 1936, pp. 235–245. Discussion of Meem type of buoyant-shaft-sinking method for subaqueous tunnel construction; towing sections; depth of flotation; joining sections.

SUBWAY CONSTRUCTION, MOSCOW. Der Bau der zweiten Linie der Moskauer Untergrundbahn, A. Spitz. *Zeit des Oesterreichischen Ingenieur- u Architekten-Vereines*, vol. 88, nos. 17/18, May 1, 1936, pp. 97–99. Progress report on design and construction of second line of Moscow subway which will have total length of 14.9 km; use of many Soviet-made tunneling shields; methods of shaft sinking.

VEHICULAR, VENTILATION. Requisiti delle gallerie per autostrade, G. Corbellini. *Ingegnere*, vol. 14, no. 5, May 1936, pp. 241–249. Study of ventilation requirements of vehicular tunnels based on Italian and American experience; graphs of carbon monoxide and carbon dioxide content of air in Italian railroad tunnel.

WATER SUPPLY, LINING. Full Circle Tunnel Lining Placed in Single Pour. *Eng. News-Rec.*, vol. 117, no. 22, Nov. 26, 1936, pp. 743–745. Description of form traveler 160 ft long, pouring in one single operation 70-ft length of concrete lining of 10-ft tunnel of Colorado River aqueduct distribution system; placing concrete; daily program.

WATER PIPE LINES

STRESSES. Efforts supportés par les tuyaux on béton de ciment posés en terre. A. Guerrin. *Travaux*, vol. 20, nos. 43, 44, and 45, July 1936, pp. 329–337; Aug., pp. 377–384; and Sept., pp. 426–430. Mathematical analysis of stresses in underground concrete pipe lines due to back fill, in light of American and European experimental studies; design of pipe lines of circular cross-section; comparison of theoretical and test results; practical rules for laying underground concrete pipes.

MAINTENANCE AND REPAIR. Experiences in Rehabilitating Large Water Mains, W. G. Banks and A. C. Inglee. *Water Works & Sewerage*, vol. 83, no. 9, Sept. 1936, pp. 327–334. Methods used at Newark, N.J., to clean and line with cement 40-year-old main of riveted steel 36 to 60 in. in diameter and 50 miles long; capacity increased beyond that when new.

WATER RESOURCES

UNDERGROUND, FLORIDA. Artesian Water in Florida Peninsula, V. T. Stringfield. *U. S. Geol. Survey—Water-Supply Paper*, no. 733–C, 1936, pp. 115–195, 11 supp. sheets. Price 20 cents. Geology and hydrology of artesian well supply; area of artesian flow; artesian head; piezometric surface; springs; areas of highly mineralized water and their relation to piezometric surface; records of wells; records of measurements of pressure heads and water levels in wells.

UNDERGROUND, LONG ISLAND. Withdrawal of Ground Water on Long Island, New York, D. G. Thompson and R. M. Leggette. *N. Y. State Dept. Conservation Water Power & Control Commission—Bul.*, GW-1, 1936, 28, pp., 1 supp. sheet. Study of water-bearing formations; use of ground water; change in rate of withdrawal since 1904; withdrawal by New York City compared with other public water-supply systems; withdrawals from different source formations; graphs showing average daily withdrawal of water for public supply.

UNDERGROUND, MASSACHUSETTS. Public Ground-Water Supplies in Massachusetts, F. H. Kingsbury. *New England Water Works Assn.—J.*, vol. 50, no. 2, June 1936, pp. 149–196. Review including 30 pages of tabulated data on water works deriving their supply from underground sources; classification of underground water supply; methods of obtaining water from ground; wells near sea; quality of ground water; ground-water treatment and protection.

UNDERGROUND, TEXAS. Ground-Water Resources of Kleberg County, Texas, P. Livingston and T. W. Bridges. *U. S. Geol. Survey—Water-Supply Paper*, no. 773-D, 1936, pp. 197–232, 5 supp. sheets. Price 10 cents. Geology and hydrology of artesian well zone; history of ground-water development; geologic formations and their water-bearing properties; utilization of ground-water supplies; fluctuations in artesian pressure and decline in head; movement of ground water; chemical character of ground water; defective wells; waste of water; well-drilling methods; well records.

WATER TREATMENT

FILTRATION. Rapid Sand Filter Efficiency in Removing Amoebic Dysentery Cysts. *Water Works Eng.*, vol. 89, no. 25, Dec. 9, 1936, p. 1626. Results of large-scale experiments at Chicago experimental filtration plant indicating that cysts are effectively removed by rapid-sand filtration.

HYGIENE. Die Wasserversorgung Deutschlands, betrachtet mit den Augen des Hygienikers, H. Bruns. *Gas- u Wasserfach*, vol. 79, no. 28, July 11, 1936, pp. 517–522. Hygienist's view of sources of water supply and water treatment in Germany; typhoid fever statistics.

PLANTS, SALEM, MASS. New Water Treatment Plant of Salem and Beverly Water Supply Board, F. A. Marston and J. W. Raymond, Jr. *New England Water Works Assn.—J.*, vol. 50, no. 2, June 1936, pp. 111–128. Design and construction of water treatment plant serving two communities having population of about 70,000; plant includes low-lift pumping station, force main, and Venturi meter, mixing tanks, coagulation basins, filters, and filtered-water reservoir; wash-water lagoons; winter construction; heating equipment; curing concrete; cost of project, $654,149.

WATER WORKS ENGINEERING

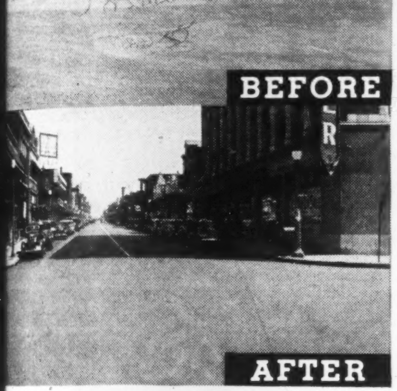
CONVENTION. N.E.W.W.A. Convention Proceedings. *Water Works & Sewerage*, vol. 83, no. 11, Nov. 1936, pp. 445–448. Brief abstracts of following papers: Development of Water Supply of City of New York, J. Goodman; Additional Water Supply for City of New York, W. E. Spear; Developing Ground-Water Supply of City of Dayton, Ohio, W. W. Moorehouse; Katadyn Process of Water Purification, F. E. Hale and R. Shapiro; Improving Operation of Rapid Sand Filters, J. R. Baylis; Operating Experience with Anthrafilt, H. S. R. McCurdy; Symposium on 1936 Floods. (Concluded.)

LITTLE ROCK, ARK. Mountain Water for Little Rock. *Eng. News-Rec.*, vol. 117, no. 21, Nov. 19, 1936, pp. 718–720. Construction of new water works for Little Rock, Ark., including earth-fill dam, 115 ft maximum height, and 32-mile concrete pipe line; features of spillway with capacity of 40,000 cu ft per sec; cost and contract data.

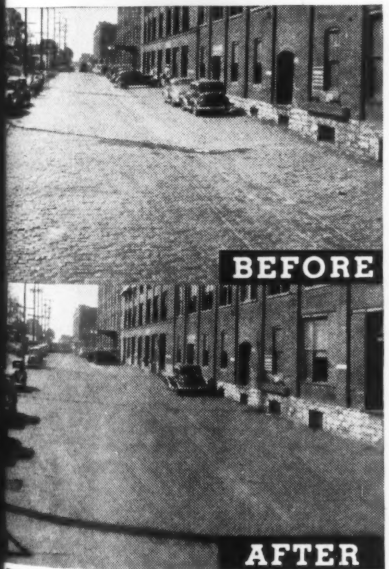
NEEDHAM, MASS. Well Yields 1,000,000 Gallons Daily with but 2.6-Foot Drawdown, J. W. Greenleaf, Jr., and B. F. Snow. *Water Work Eng.*, vol. 89, no. 25, Dec. 9, 1936, pp. 1594–1599. Water supply and distribution system for city with population of 12,000; source is gravity-packed well pumped at 4.5-mgd test rate; types of wells studied.

BEFORE
AFTER

Clark Avenue, looking toward 14th Street. Old granite blocks re-surfaced with Hot Mix Asphaltic Concrete



Locust Street from Leonard Avenue. Re-surfaced with Hot Mix Asphaltic Concrete.



Eighth St. looking toward Chouteau Ave. Very rough granite block covered with Hot Mix Asphaltic Concrete using a minimum of ¾" thickness.

How St. Louis re-surfaced 85 miles of streets with ASPHALT at LOW COST

A total of 1,800,000 square yards of pavement has been re-surfaced in St. Louis during the past three years with *asphalt.* That's equivalent to 85 miles of street with a 36-foot width.

In carrying out this re-surfacing program, the engineers had to consider several essential factors. First—*Economy,* due to a limited budget and the large amount of re-surfacing involved. Second—*Safety,* by providing a non-skid, non-glare surface. Third—*Durability,* under heavy traffic demands. And fourth—*Quick Application,* to avoid interference with traffic.

The Standard Oil Company (Indiana) which furnished most of the asphalt for this work, is, of course, pleased that the St. Louis Engineers approved its material and found it satisfactory in all respects.

Here is dramatic proof of the adaptability of asphalt—proof of its economy, safety, durability and quick application possibilities! Let a representative from *your* local Standard Oil office talk over *your* paving problems with you. This service is without obligation or cost—yours for the asking—and it may very readily be an economical solution to all your paving needs. Phone at any time. Take advantage of Standard's long years of experience in every kind of paving problem.

Here's What Happened in St. Louis

A large amount of re-surfacing was placed over sheet asphalt. A special mix was used, consisting of a hot mix at 250° F. using 95% Lead Belt Chat and 5% 85-100 penetration Asphalt Cement. This averaged 60 pounds to the square yard.

In re-surfacing the granite or brick pavement the same mix was used, requiring 125 pounds per square yard. There are 16 miles of this type of pavement on Broadway.

This work was carried out under the personal direction and supervision of Frank J. McDevitt, Director of Streets and Sewers, City of St. Louis.

New surface was able to bear traffic immediately after compacting!

A survey through the bus companies and taxi cab drivers brought enthusiastic praise of three features of the re-surfaced pavement: *non-skid, non-glare* and *freedom from tire noise.*

About 100,000 square yards of re-surfacing was done at night from 9 PM to 4 AM. This night work was done on heavy traffic streets with portable stands, using auto headlights. The record for re-surfacing in one night was 2500 square yards, using 12 men.

No seal coat was used on any of this work.

Copr. 1937, Standard Oil Co.

Asphalt for every purpose

STANDARD OIL COMPANY
(INDIANA)

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

"Caterpillar" Issues Application Book

A BOOKLET of 175 pages titled "Application Data—'Caterpillar' Diesel Engines" has just been issued by Caterpillar Tractor Company of Peoria, Illinois. This reference book contains facts, figures, tables, short-cut formulas, and typical examples to assist in the selection of the right engine to fit any particular job.

Published primarily for "Caterpillar" salesmen, the Application Book's contents pertain chiefly to engines of this manufacture. However, these engines are installed in practically every field of power application, so that the new compilation should have broad interest from both the user's and the student's standpoints. It facilitates an analysis of the factors governing the installation of a prime mover for any particular job. The methods involved have been reduced to simple data and formulas.

The book may be obtained from Caterpillar Tractor Company, Peoria, Illinois. The price is $5.00.

New Low-Cost Panelboard

A NEW low-cost Nofuze panelboard for general 115,115/230-volt a-c distribution with branch circuits ranging from 15 to 50 amperes, capacity and selling for approximately two-thirds the price of previous circuit breaker type panelboards is announced by Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

The new panelboard is particularly suited for application in industrial plants, buildings, schools, hotels, and all types of commercial structures, yet because it uses the multi-breaker units recently developed for load centers the cost is only slightly higher than for conventional switch and fuse type panelboards and offers all the advantages of circuit breaker protection.

The new Nofuze panelboard is designed for 115,115/230-volt a-c service in a range of 4 to 40 circuits in 2-circuit steps. Bus arrangements for single phase, 3/2-wire, and 3-phase 4-wire services are provided. Branch circuit ratings of 15, 20, 25, 35, and 50 amperes are available. The multi-breaker units employed permit a compact design, the box dimensions being held to 15 in. wide by 4 in. deep, permitting mounting in spaces where other panels could not be used, such as the face of columns.

The new panelboard together with the new low-cost load center and the standard line of Nofuze Deion circuit breaker lighting and power panels developed by Westinghouse engineers now makes circuit breaker protection possible and economical in all installations from the smallest home to the largest manufacturing plant.

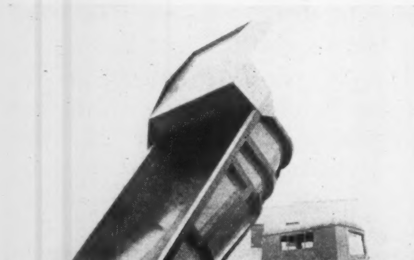
Arc Welding Lessons

LESSONS IN ARC WELDING—Published by the Lincoln Electric Company, Cleveland, Ohio, to provide arc welding operators and other interested individuals a thorough working knowledge of the practical application and use of arc welding, has been reissued in considerably enlarged form. The volume, profusely illustrated by sketches, now contains 44 lessons and approximately 130 pages.

"Lessons in Arc Welding," beginning with general fundamental suggestions, takes the student by easy stages through all the imporant phases of practical arc welding and affords him thorough instruction on the subject. "Lessons in Arc Welding" is mimeographed on pages 8 by 11 in. with simulated leather binding. Copies are mailed, postpaid, to any address in the United States for 50 cents each, 75 cents elsewhere.

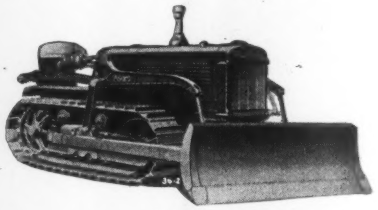
Streamlined Dump Body

A NEW design in open end, hydraulic hoist dump bodies is reported by the Easton Car & Construction Company, Easton, Pa. This body is intended for use on any heavy excavating job. It is an all steel body using high carbon plate steel surfaces and a structural steel frame in arc welded and riveted assembly. A hydraulic hoist, supplied and mounted with the body by Easton, gives a powerful and dependable elevation to a steep angle. The unusual shape of this body was scientifically designed and proportioned to give a maximum loading capacity per top weight of body and hoist, and a technically correct load distribution. A sturdy shelving of plate steel extends over and protects the cab of the truck during loading. The capacity of the truck pictured is seven cu yds shaped and approximately nine cu yds heaped. Other capacities and dimensions are available to fit truck manufacturers' standards or users' wishes.



New Tractor Equipment Line Is Announced by Bucyrus-Erie Company

MODERN SIMPLICITY of design together with unusually fast and powerful hydraulic blade action are the outstanding features of the Bullgrader and bulldozer—the two first units in Bucyrus-Erie Company's new tractor equipment line.



Many Bullgraders and bulldozers have been in use in the field during the past several months. According to the manufacturer, these units have already set new dirt-moving performance standards on widely varied jobs such as in grading highways, working in mines and quarries, building oil sumps, constructing logging roads, building airports, and working on large dam projects.

The name "Bullgrader" is exclusive with Bucyrus-Erie Company, and designates the double-purpose unit which can be used both for grading and for bulldozing. The Bullgrader blade may be angled quickly to the right or left for continuous side-casting, or it may be set straight across for bulldozing. The blade may also be tilted for filling, terracing, or establishing a grade.

The large, twin, hydraulic cylinders which power the blade action of both the Bullgrader and bulldozer, operate at low oil pressure—350 lbs maximum. A single control, conveniently placed for the operator, enables him to raise, lower, hold, or float the blade. He commands a blade travel speed of 32 in. in three seconds. Pressure release ports, exclusively used by Bucyrus-Erie Company on both these units, automatically cut off the hydraulic power when the blade reaches its highest or lowest position. It is claimed that not only do these release ports eliminate "hydraulic hammer" and the consequent danger to hose joints and packing, but they minimize the amount of tractor power required for blade action.

Both the Bullgrader and bulldozer are so designed as to afford maximum visibility for the operator. Another feature emphasized by the manufacturer is that these units are quickly and easily mounted on a tractor without drilling, cutting, or defacing any part of the tractor frame.

Full particulars concerning the Bullgrader and bulldozer may be obtained by writing to Bucyrus-Erie Company, South Milwaukee, Wisconsin.

Say Goodbye

TO MAINTENANCE COSTS

HERE'S A SURE WAY TO ELIMINATE PAINTING, RE-FLOORING, FIRE DAMAGE AND OTHER COSTLY BRIDGE REPAIRS

• These pictures tell the story. Instead of spending money for further repairs on this wooden bridge, the officials wisely replaced it with a sturdy Armco Multi Plate arch. The arch itself consists of heavy-gage corrugated iron plates bolted together and securely anchored in the high masonry side-walls.

This metal arch has ample strength to support the heaviest loads. Being made of durable Armco Ingot Iron, it should last a lifetime—without upkeep or repairs. If conditions change, it can easily be widened or relocated without any loss of material.

Let an experienced Armco man help you obtain these advantages on your next small bridge replacement. And remember, unskilled labor can put up a Multi Plate structure almost as quickly and economically in winter as in spring. To get complete information just fill in the coupon and address it to:

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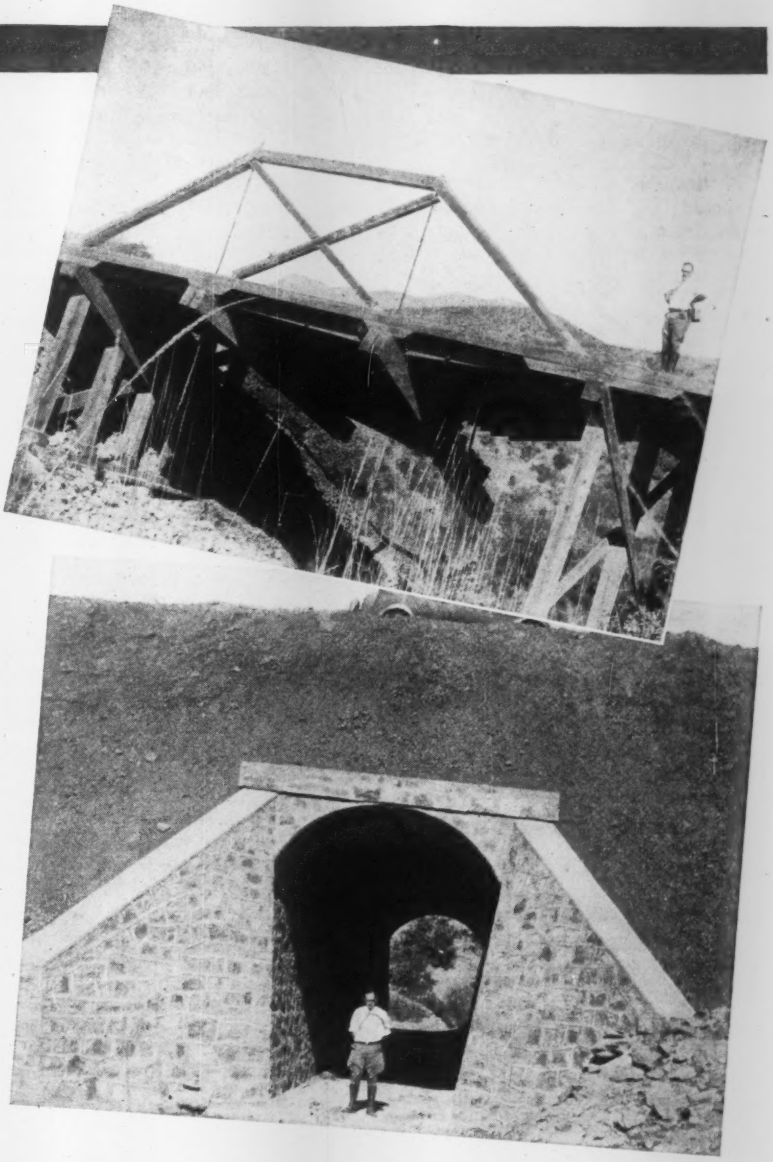


Fairbanks-Morse Diesels

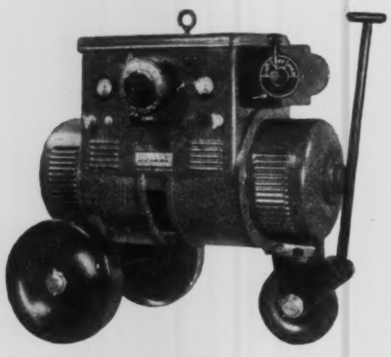
An attractive booklet, "Fairbanks-Morse Diesels," illustrates and describes present models in the line of Fairbanks-Morse Diesel engines. An introduction traces briefly the development and explains the operation and uses of Diesels.

With the illustrations and discussions of operating features of the various F-M models, are given applications in marine, stationary, and portable service. In some cases typical installations are pictured and described. The Fairbanks, Morse & Company line of Diesel engines, offers 4-cycle, 2-cycle with automatic scavenging and 2-cycle with pump scavenging, and 2-cycle with pump scavenging, models for economical, dependable service wherever power is used.

Fairbanks-Morse Diesel engines in use total nearly 3,000,000 horsepower, representing a background of experience in Diesel design and manufacture.

Hobart Arc Welders

A new development in arc welding is reported by The Hobart Brothers Company, Troy, Ohio, manufacturers of Hobart "Simplified" Arc Welders.



The new Hobart "Serial MN Current-Saving Models" embody what is termed as "Selective Motor HP Control." It is claimed that only $^1/_3$ the usual starting current is required—the power factor of the machine and its efficiency are materially improved—and it is possible to use the equivalent of a motor of one-half the hp rating for welding in ranges up to $^1/_2$ to $^2/_3$ the rated capacity of the generator.

The operation of the "Selective Motor HP control" is simple. A convenient latch locks the handle in the "Low" position, where only half the rated motor hp is used for starting and for welding up to $^1/_2$ the rated generator capacity in continuous manual arc welding, or up to $^2/_3$ rated capacity for intermittent welding.

To operate at higher rates, the handle is turned to the "High" position. It is possible to start and weld in the "High" position.

The New "Series MN Current-Saving Models" are available in 75 amperes—$1^1/_2$ to 3 hp, 160 amperes—$2^1/_2$ to 5 hp, 150 amperes—5 to 10 hp, 200 amperes—$7^1/_2$ to 15 hp, 300 amperes—10 to 20 hp, 400 amperes—$12^1/_2$ to 25 hp, and 600 amperes—20 to 40 hp.

Folders Announced

Diamond Drill—Ingersoll-Rand Bulletin No. 2159-A shows both details and "in-use" pictures of the Explorer Diamond Drill, adaptable for all types of exploratory drilling within its range. 8 pages, $8^1/_2$ by 11 in. Ingersoll-Rand Company, 11 Broadway, New York, N.Y.

Dragline—A 20-page booklet, $8^1/_2$ by 11 in., very completely illustrates the Model 95 Northwest Dragline. The capacity, speed, and power of the unit are described; and important features of its construction are pictured and discussed. Northwest Engineering Company, 28 East Jackson Blvd., Chicago, Illinois.

Jackbits—A new booklet, Form 2304 covers the characteristics and uses of jackbits for drilling rock. It also gives dimensions and prices of jackbits and jackrods. Ingersoll-Rand Company, 11 Broadway, New York, N.Y.

Lubricant for Diesel Engines—An article on the development by Sinclair of a new Diesel Lubricant for Caterpillar Diesel Engines is published in The Service Factor. Copies of this interesting and instructive article will be forwarded by Sinclair Refining Company, 630 Fifth Ave., New York, N.Y.

Meter—Bulletin No. 52 illustrates and describes the Simplex Type M5 Meters. The design principle and details; accuracy; testing; low head service; and a capacity table of the meter are covered. 8 pages, $8^1/_2$ by 11 in. Simplex Valve & Meter Company, 6719 Upland Street, Philadelphia, Pa.

Motors, Explosion Tested—Westinghouse Type SK DC motors, built in sizes from 5 to 75 horsepower and 115, 230, and 550 volts, are described in a 2-page, $8^1/_2$ by 11 in. leaflet. Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

Oxygen Lance—An 8-page booklet, profusely illustrated with diagrams and pictures describes exactly what the oxygen lance is, how it is used, and what it will do. $8^1/_2$ by 11 in. The Linde Air Products Company, 30 East 42d Street, New York, N.Y.

Polyphase Detachable Meters—The new line of Westinghouse polyphase detachable meters—types CS-2, CS-5, CS-7, and CS-8—is described in Catalog Section 42-210. Applications, construction, operation, adjustment outline dimensions, and wiring diagrams are included. $8^1/_2$ by 11 in., 16 pages, illustrated. Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

Power Pumps—Characteristics and applications of power pumps are discussed in detail in Fairbanks-Morse Bulletin 6160 covering duplex power pumps. This booklet lists and illustrates the sizes and capacities of the two lines of Fairbanks-Morse duplex power pumps. Fairbanks, Morse & Company, 900 So. Wabash Ave., Chicago, Illinois.

Rock Drills—The Worthington Rock Master, a mobile, all-purpose drill is described and illustrated in a 12-page, 8 by $10^1/_2$ in. booklet. Screw-Feed Drifters are covered in a 4-page booklet. Worthington Pump and Machinery Corporation, Harrison, N.J.

Water Level Recorders—The latest addition to the line of Friez water level recorders is described in a 4-page, $8^1/_2$ by 11 in. folder. Julian P. Friez & Sons, Inc., Baltimore, Md.

Welders—The Lincoln Model SA 150 welder is described in a 4-page, $8^1/_2$ by 11 in. folder, illustrated. A similar folder gives the facts on the Lincoln "Shield Arc SAE" welder. Lincoln Electric Company, Cleveland, Ohio.

Welding Pipe Lines—An improved welding method used in the construction of over 5,000 miles of cross-country pipe lines is discussed in "Lindewelding Pipe Lines," a 32-page, $8^1/_2$ by 11 illustrated, Linde Air Products Company, New York.

New $^5/_8$-Yd Excavator

With the announcement of its new 19-B, Bucyrus-Erie Company adds a $^5/_8$-yd excavator to its line.

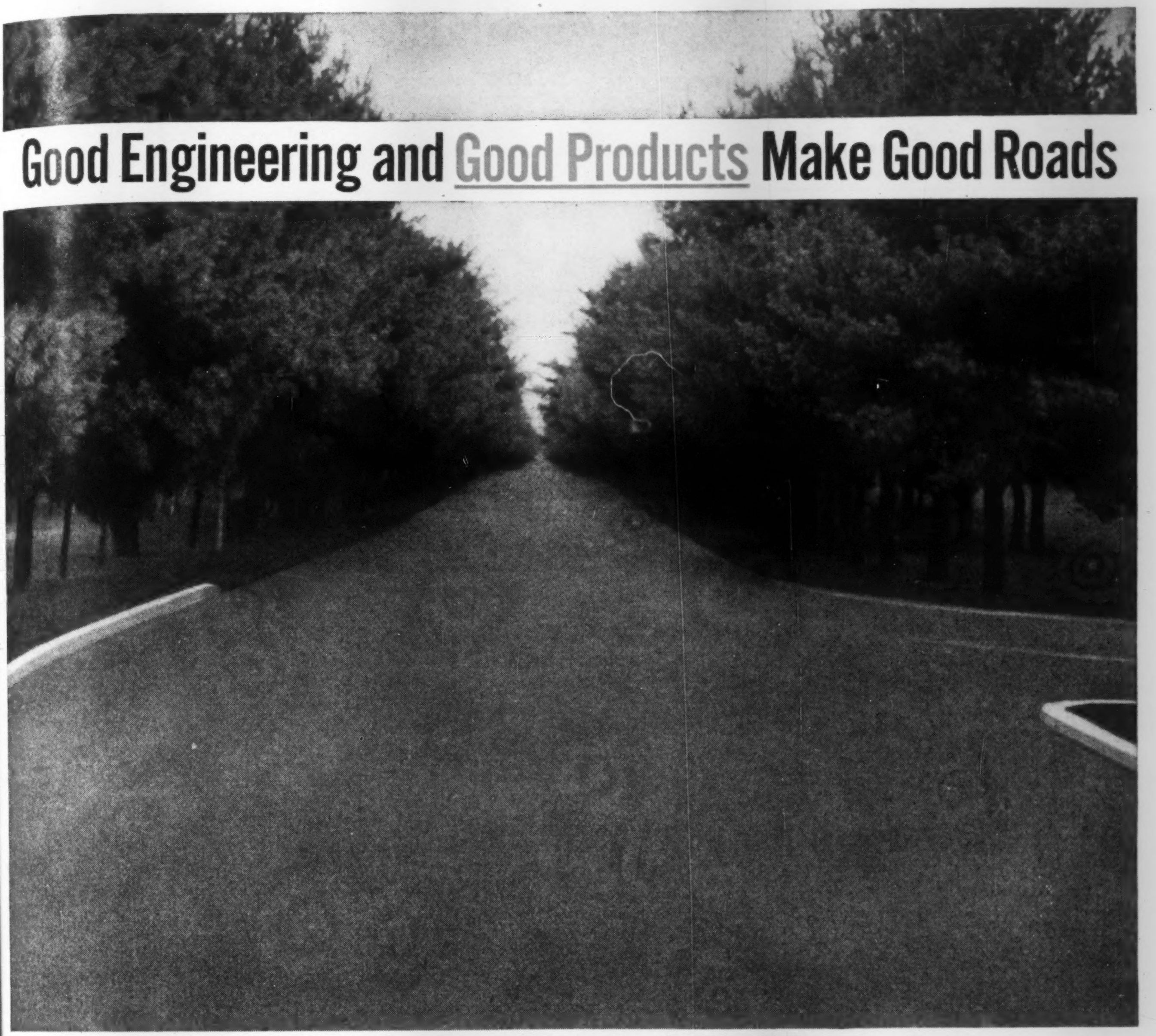
The 19-B weighs only 16 tons; offers a travel speed of $1^3/_4$ M.P.H.; swing speed of $4^3/_4$ R.P.M.; and a hoist line speed of 184 F.P.M. It is available for gasoline, electric, or Diesel power. Because of its compact design, the 10-B may be moved from job to job at fast trucking speed on a special trailer available for it.

In every detail of design the new $^5/_8$-yd machine is constructed for high-speed performance as well as rugged strength. An air-conditioned, streamlined cab not only provides full visibility and complete ventilation for the operator, but with doors opening on all sides, it also offers quick accessibility to the main machinery.

Like the 10-B, the narrow overall width and short tail swing of the 19-B permits normal operation in tight quarters, in traffic, in narrow alleys, or close to a wall or bank. Its great lift or dumping height gives it an unusual working range.

Seven types of front-end are available, making it possible to convert this machine quickly and easily to the type of operation best suited to the job. With the simple addition of front-end equipment, it can be changed from shovel to dragline, clamshell, lifting crane, dragshovel, skimmer, or backfiller.

An illustrated bulletin, describing the new 19-B $^5/_8$-yd machine in detail, is available by writing Bucyrus-Erie Company, South Milwaukee, Wisconsin.



Good Engineering and Good Products Make Good Roads

Socony Asphalt, Standard Brand, New York State Reservation, Saratoga, New York.

Socony Asphalt Road Oils · Socony Asphalt Joint Fillers · Socony Waterproofing Asphalt · Socony Cut-Back Surfacing Asphalt · Socony Asphalt Binder A for surface treatment · Socony Refined Asphalt for sheet asphalt paving · Socony Cold Patch Asphalt for all types of patching · Socony Asphalt Binders B & C for penetration work (Asphalt Macadam) · Socony Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete) · *Specifications and all other particulars furnished on request.*

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STANDARD OIL OF NEW YORK DIVISION

Men Available

These items are from information furnished by the Engineering Societies Employment Service, with offices in Chicago, New York, and San Francisco. The Service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 87 of the 1936 Year Book of the Society. To expedite publication, notices should be sent direct to the Employment Service, 31 West 39th Street, New York, N. Y. Employers should address replies to the key number, care of the New York office, unless the word Chicago or San Francisco follows the key number, when it should be sent to the office designated.

Construction

Construction Engineer-Estimator; Jun. Am. Soc. C.E.; registered professional engineer; 36; married; 13 years experience with building contractors, office buildings, schools, hospitals, industrial reinforced concrete buildings, institutional and monumental buildings, estimating, purchasing, job management; 1 year water supply and sewage disposal. Eastern states only. C-2194.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 30; graduate; New York State license; 7 years with general contractors on tunnel construction, compressed air work as field engineer, hydrographic construction, dredging, soundings, surveys, building construction, design, estimating, inspection. Employed on construction in Washington, D.C. Available in March. Location, East. D-1921.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 37; married; New York license; 15 years experience in construction. Knowledge of costs, methods, materials; good executive. Desires position as estimator, superintendent, or office engineer with general contractor in building or heavy construction. Location immaterial. D-5698.

Civil and Construction Engineer; M. Am. Soc. C.E.; 47; married; 4 years railroad location and construction; 4 years topographical surveying; 4 years municipal construction; 2 years as engineer officer, A.E.F.; last 13 years engineer and superintendent of construction for large oil corporation, plants, service stations, piping, etc. Available now. C-5523.

Construction Engineer; Assoc. M. Am. Soc. C.E.; 39; graduate civil engineer; registered professional engineer, state of Pennsylvania; 13 years experience, including railroad maintenance, dredging, many types of heavy concrete and steel construction, land surveying, over 6 years on two of the largest suspension bridges. Available immediately. D-5277.

Design

Architectural Engineer; Jun. Am. Soc. C.E.; 30; graduate of Ohio State University; experienced in layout, architectural and structural design, specifications, estimates and supervision of construction of public utility buildings, sewage treatment works, sewers, and pavements. Adaptable personality. Available on reasonable notice. Location immaterial. D-35.

Civil and Structural Engineer; Assoc. M. Am. Soc. C.E.; 42; married; graduate of Lehigh University; 20 years experience on design, detailing, and construction of large industrial plants; commercial buildings; church buildings; railroad and highway bridges of all types; foundations, wharves, docks, piers; excavation and dredging work. Temporarily employed. Available in two weeks. B-6928.

Executive

Civil Engineer; Assoc. M. Am. Soc. C.E.; 40; widower; New York State license; professional engineer and land surveyor; 18 years broad experience in design and supervision of all types of construction; buildings, industrial plants, public utilities, highways, sewers, and park developments. Qualified to plan and direct all phases of work, to make valuations, reports, surveys, or as consultant on special construction problems. Available. D-5654.

Civil Engineer; M. Am. Soc. C.E.; 20 years varied experience, at home and abroad, on harbors, canals, hydroelectric development, railways, highways, bridges, buildings, utilities, and industries, including construction management and project development. Native, registered under American laws, and revalidated abroad. D-5710.

Civil Engineer; M. Am. Soc. C.E.; married; 25 years diversified experience on excavation, masonry, foundations, sewers, structural steel, and bridge work; estimating, making and checking plans, and supervising construction. Salary and percentage of profits. Available immediately. B-4134.

Civil Engineer; Jun. Am. Soc. C.E.; B.S. C.E.; 31; single; 1 year as assistant to superintendent on reinforced concrete and structural steel construction; estimates; 3 years on surveys for electric transmission lines, of rivers for hydroelectric development, and for electric railways; 5 years on horizontal geodetic control—field work, office computations; field engineer; computer; coal land surveys; desires opportunity with electric power company. D-5769.

Managing Engineer; M. Am. Soc. C.E.; Pennsylvania state registration; supervision of design, sales, plant, and field operations of steel fabricating and construction business. Qualifications particularly valuable to general management of any industry. Prefers location in western Pennsylvania or Ohio. Available immediately. C-5095.

Estimating Engineer; Assoc. M. Am. Soc. C.E.; 49; B.S. in C.E.; 10 years field experience in engineering and construction; 14 years as executive office engineer and building cost estimator. For 10 years, employed by one of country's largest building contractors, in full charge of estimating. Would like permanent position with high-class company. B-1141.

Junior

Civil Engineer; Jun. Am. Soc. C.E.; 23; single; B.S.E. and C.E., 1935, College of the City of New York; $2^1/_2$ years as library assistant at College of the City of New York; 6 months surveying; $1^1/_2$ years drafting on city planning survey; good structural and topographical draftsman; desires opportunity in civil engineering. D-5665.

Civil Engineer; Jun. Am. Soc. C.E.; 25; single; B.S.C.E., Lewis Institute, 1935; 1 year with utility company on line surveying and line estimating. Desires position with possibilities of advancement; best of references; location immaterial; available on two weeks' notice. D-5718.

Civil Engineer; Jun. Am. Soc. C.E.; 23; single; B.C.E., Clarkson College of Technology, 1936; 3 months with county highway department as assistant engineer; 3 months as engineer's helper on dredging contract. Desires opportunity with engineering firm, leading to field work. Location immaterial. Available. D-5683.

Civil Engineer; Jun. Am. Soc. C.E.; 22; B.S.C.E., New York University, 1936; 6 months with New York State Highway Department, on construction of the Hutchinson River Parkway Extension as inspector of pavement, structural concrete, stake-out work, and prepared detailed estimates and progress reports. Desires opportunity in construction or structural fields. Available. D-5040.

Civil Engineer; Jun. Am. Soc. C.E.; 22; single; Christian; B.S.C.E., New York University, 1935. Assistant instructor in surveying field classes at college; 3 years experience as commercial photographer. At present employed in milk condensery in Wisconsin. Desires position with opportunity for advancement. Location in East preferred. Available in two weeks. D-3990.

Civil Engineer; Jun. Am. Soc. C.E.; 29; married; B.C.E. degree; $2^1/_2$ years surveying for highway and sewer construction. Desires position with opportunity in any branch of civil engineering. Immediately available. D-3014.

Civil Engineer; Jun. Am. Soc. C.E.; 28; B.S. in C.E., New York University; $1^1/_2$ years with New York City Department of Parks, WPA, as transitman on property surveys; 8 months with New York City Board of Transportation on subway construction; employment in any branch of civil engineering desired. D-1119.

Assistant Civil Engineer; Jun. Am. Soc. C.E.; New Jersey state license; 29; healthy and responsible; Tau Beta Pi graduate; competent senior draftsman in highways, reinforced concrete structures, and state project planning; iron and steel sales engineering. Available in 2 weeks. Desires permanent work in planning, design, or construction with progressive engineering or contracting firm. C-7279.

Civil Engineer; Jun. Am. Soc. C.E.; 23; single; B.S.C.E., New York University, 1934; 2 months experience as draftsman; $1^1/_2$ years experience as rodman and transitman on topographical and construction surveys. Desires position with engineering or contracting firm, preferably structural steel firm. Location, New York. Salary secondary. D-5768.

Civil Engineer; Jun. Am. Soc. C.E.; 24; B.S.C.E., Lehigh University, 1933, with high honors; 3 summers as assistant in surveying school; $3^1/_2$ years on flood-control projects; $1^1/_2$ years in charge of soils and concrete laboratory; 3 rolled-earth dams and concrete work, including inspection and surveying. Desires position with engineering firm in dams, structures, or other field. Location, eastern United States. Available in 3 weeks. D-5603.

Highway Designer and Office Engineer; Jun. Am. Soc. C.E.; 29; married; I.C.S. graduate; 10 years experience in computing, designing, and checking highway plans; now employed as assistant office engineer. Desires change. Will furnish detailed experience record upon request. D-5778.

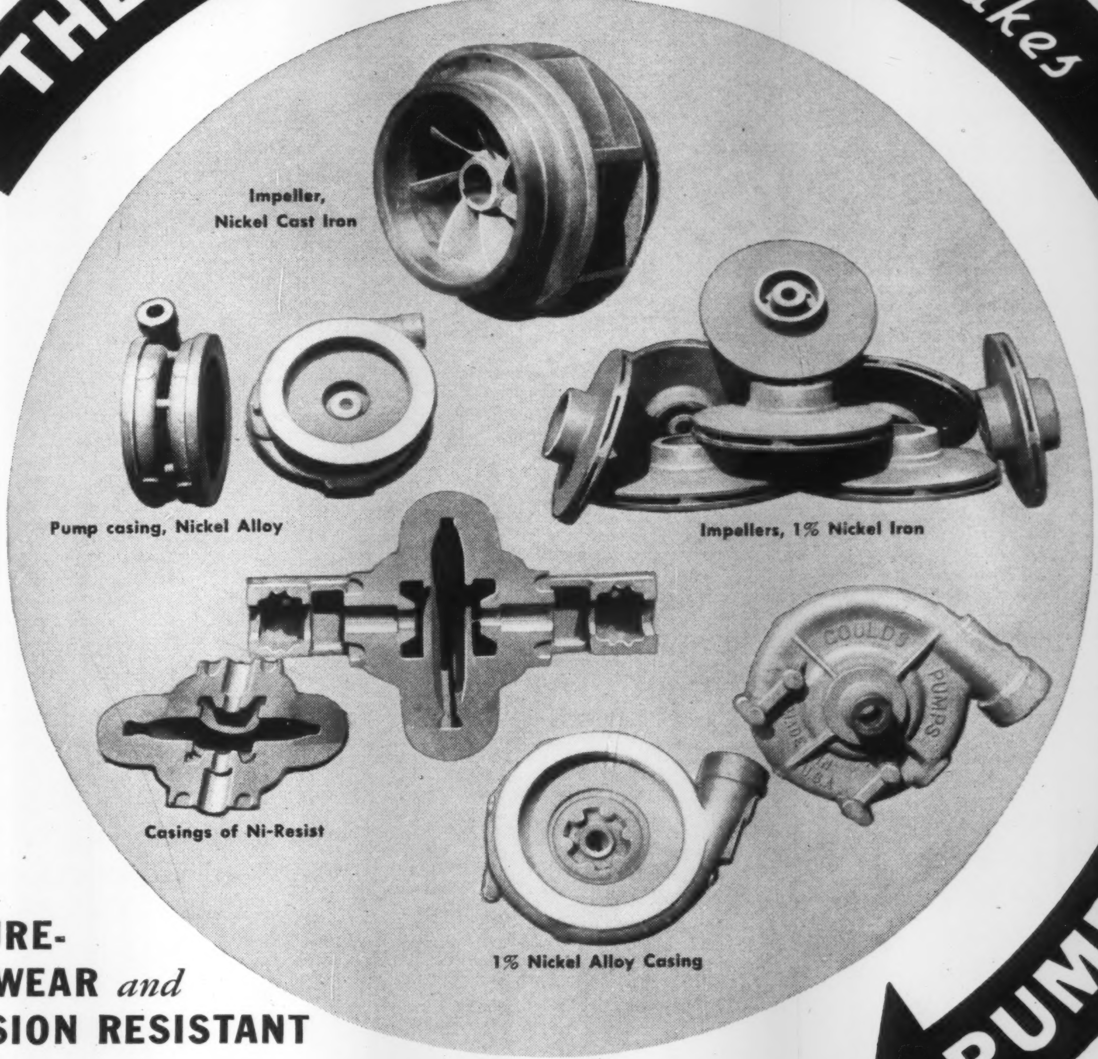
Civil Engineer; Jun. Am. Soc. C.E.; 24; D.C.E., Rensselaer Polytechnic Institute, 1937; 3 years graduate work on fellowship in bridges and indeterminate structures; chief minor mathematics. Reads French. Familiar with photoelastic stress analysis, Beggs deformeter, calculating machines. Tau Beta Pi, Sigma Xi. Desires work in bridge or structural engineering, or teaching structures. Available June 15. D-4805.

Teaching

Structural Engineer; Assoc. M. Am. Soc. C.E.; B.S., M.S., and Ph.D.; 36; experience in design, research, and teaching; will consider teaching position; available September 1. C-3736.

Instructor, Civil Engineering; student; single; bachelor's and master's degree of civil engineering; majored in hydraulics; minored in surveying; one year as assistant instructor in surveying; experience in construction, publication work; university faculty position desired with opportunity for research study. D-5486.

THESE *show how Gould makes* PUMPS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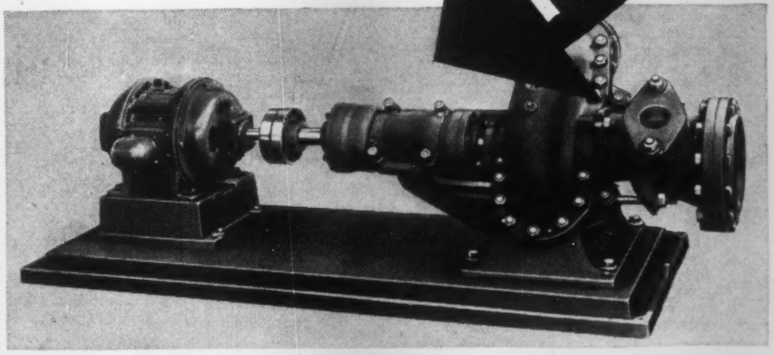

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THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

ASSOCIATE PROFESSOR; Assoc. M. Am. Soc. C.E.; engineer with 10 years practical experience on design of buildings and bridges; 3 years teaching structural engineering and theoretical and applied mechanics; desires to make teaching change. Has graduate and undergraduate degrees from leading universities. At present teaching above subjects in large university. Location in East or South preferred. Available September 1937. D-1860.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 28; married; B.S.C.E.; M.S.C.E.; additional graduate work in structures, highways, hydraulics, mechanics; 7 years teaching at 3 schools, including 6 years teaching structures, surveying; 1 year highways, railroads, drawing, mathematics; $1\frac{1}{4}$ years structural detailer; 1 year highway, lock construction, surveying; several publications. C-6966.

ASSISTANT PROFESSOR; Jun. Am. Soc. C.E.; married; 29; B.S.C.E.; M.S., mechanics and hydraulics; 4 years successful teaching, past 2 years in charge of civil engineering work; 3 years practical experience in public utility and government bureaus on hydraulic and hydrological studies. Desires change to position teaching hydraulics, hydrology, water supply, mechanics, or highways in established engineering department. C-8660.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 28; married; B.S. in C.E., graduate fellow teaching surveying, and candidate for M.S. in C.E.; member of Tau Beta Pi, Phi Kappa Phi; $4\frac{1}{2}$ years experience in surveying; 3 month detailing and estimating reinforcing steel. Will consider any location. Available for appointment on civil engineering faculty for 1937. D-5754.

PROFESSOR; Assoc. M. Am. Soc. C.E.; married; 37; Sc.B. and M.S.; 4 years experience as instructor in hydraulics, surveying, highways, structures; 9 years as hydraulic and structural engineer engaged in studies and design of large water supply project. Desires position teaching any of above subjects, preferably with opportunity for research work in hydraulics. Now employed. Available on reasonable notice. D-5779.

SANITARY AND PUBLIC HEALTH ENGINEERING; Assoc. M. Am. Soc. C.E.; B.S. civil engineering; C.E. sanitary engineering; M.S. public health; married; 3 children; 20 years broad practical experience in construction, design, consulting, administrative, and research work. Specialized in water supply, sewage disposal, stream pollution investigation, public health engineering. D-477.

CIVIL ENGINEER; Assoc. M. Am. Soc. C.E.; 37; B.S. in C.E.; married; 12 years professional experience, principally in highway and municipal improvement design and construction; 2 years teaching experience; graduate study in highways, contract and specification writing; desires position with opportunity for research and continuation of graduate studies. C-5040.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1936. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

ANCIENT BRIDGES OF WALES AND WESTERN ENGLAND. By E. Jervoise. London, Architectural Press, 1936. 180 pp., illus., 7 × 5 in., cloth, 6s. 6d.

This volume, the fourth of a series upon the ancient bridges of England, completes a survey made for the Society for the Protection of Ancient Buildings. It provides descriptions of all early bridges in the region in question, with their histories and references to the sources of information. Excellent photographs of ninety-one bridges are included. The series contains much of interest to the student of bridge history.

BERICHTE DES DEUTSCHEN AUSSCHUSSES FÜR STAHLBAU, Ausgabe B, Heft 6. Berlin, Julius Springer, 1936. 22 pp., illus., diagrs., charts, tables, 11 × 8 in., paper, 3.60 rm.

The investigations here reported were made at the National Testing Laboratory in Berlin. The first is an investigation of the resistance to buckling of centrally and eccentrically loaded supports with butt joints. The second is an investigation of the influence of shrinkage stresses upon the resistance to buckling of welded compression members under central and eccentric loads.

(KEMPE'S) ENGINEER'S YEAR-BOOK OF FORMULAE, RULES, TABLES, DATA, & MEMORANDA FOR 1937, 43d Annual Issue. Revised by L. St. L. Pendred. London, Morgan Brothers, 1937. 2676 pp., illus., diagrs., charts, tables, 7 × 5 in., leather, 31s. 6d.

This well-known reference book has reached its forty-third annual issue. It deals with every phase of engineering and, by reason of its frequent issue, affords a convenient survey of modern practice. In this edition the sections upon machine tools, airplane engines, and paints and varnishes have been thoroughly reworked.

MACHINE DESIGNERS' GUIDE. By K. W. Najder, 2 ed. Ann Arbor, Mich., Edwards Brothers, 1936. 259 pp., diagrs., charts, tables, 9 × 6 in., cloth, $2.75.

This volume, designed to assist the practical engineer and designer in the quick solution of everyday problems without the use of higher mathematics, contains formulas and tables relating to mechanics, graphics, and the strength of materials. The use of these data is illustrated by a collection of sixty-six worked examples.

MECHANICAL TESTING OF METALS AND ALLOYS. By P. F. Foster. London and New York, Pitman Publishing Corporation (2 West 45th Street), 1936. 267 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $3.75.

This is a convenient manual for those concerned with mechanical testing and for students of the strength of materials. The work is confined to the types of testing equipment found in modern test rooms and laboratories, and to the range of tests usually made. The equipment and its use are described in clear detail, with the theory that underlies present developments in testing. A brief bibliography is included.

OUTLINE OF THE HISTORY OF MATHEMATICS. By R. C. Archibald. 3 ed. Oberlin, Ohio, Mathematical Association of America, Inc. 62 pp., 9 × 6 in., paper, 50 cents.

This interesting sketch of the development of mathematics is based upon two lectures delivered in 1931 at a summer school for engineering teachers organized by the Society for the Promotion of Engineering Education. The history covers the important developments before the nineteenth century, as well as more recent developments of topics usually discussed in undergraduate colleges. A good bibliography is appended.

PLUMBING ENGINEERING. By Walter S. L. Cleverdon. New York, the Pitman Publishing Corporation (2 West 45th Street), 1937. 445 pp., illus., tables, diagrs., charts, $8\frac{1}{2}$ × $5\frac{1}{2}$ in., cloth, $3.50.

In this volume the author has introduced the study of hydraulics and pneumatics, where necessary to clarify certain plumbing problems. The requirements of the National Board of Fire Underwriters are given completely for standpipe and sprinkler systems. High buildings, with their problems of excessive pressures, water hammer, and high velocities, are treated at length, as are many other subjects in the field.

PROCEDURE HANDBOOK OF ARC WELDING, DESIGN AND PRACTICE, 4 ed. Cleveland, Ohio, Lincoln Electric Co., 1936. 819 pp., illus., diagrs., charts, tables, 9 × 6 in., leather, $1.50.

The equipment and technique of arc welding, the design of arc-welded machinery and structures, and the applications of arc welding in manufacturing, construction, and repairs are discussed in a practical manner in this well-known work. The new edition contains much new matter covering recent developments and applications.

DIE PRÜFUNG DER MISCHVORGÄNGE IM BITUMINÖSEN STRASSENBAU. (Mitteilungen des Forschungsinstituts für Maschinenwesen beim Baubetrieb, Heft 9). By E. Gerlach. Berlin, VDI-Verlag, 1936. 18 pp., illus., diagrs., charts, tables, 12 × 8 in., paper, 8 rm.

This report is concerned with methods for testing bituminous paving mixtures. The various methods by which the thoroughness of mixing may be tested are described and evaluated, the effectiveness of various types of mixtures is discussed, and the influence of heat, speed, etc., is investigated. The effect of improved mixing upon the life of the pavement is considered.

REGELN FÜR WASSERMENGEN-MESSUNGEN BEI ABNAHME VON WASSERKRAFTMASCHINEN. (VDI-Wassermengenmessregeln). Edited by Verein deutscher Ingenieure and Reichsverband der deutschen Wasserwirtschaft. Berlin, VDI-Verlag, 1936. 12 pp., illus., diagrs., charts, tables, 12 × 8 in., paper, 2 rm.

This pamphlet gives the official rules for measuring the water in acceptance tests of hydraulic motors. Exact directions for weir and current-meter measurements are given, together with brief directions for other methods that may be used in special cases. An extensive bibliography is included.

STATISTICAL YEAR BOOK OF THE WORLD POWER CONFERENCE, No. 1, 1933 and 1934. Edited, with an Introduction and Explanatory Text by F. Brown. London, World Power Conference, Central Office; American Committee, Interior Bldg., Washington, D.C., 1936. 111 pp., tables, 11 × 9 in., paper, $5.

This year book contains statistics of the resources, stocks, imports, exports, and consumption of power and power sources during 1933 and 1934 for all countries for which it was possible to obtain information. The power sources included are coals, brown coal and lignite, peat, wood, petroleum, benzoles, natural gas, water power, and electricity. In most cases the statistics were specially supplied by the National Committees of the World Power Conference and by government agencies, and conform to standard definitions given in the text. The book provides a collection of unusually comprehensive and accurate data, which have the great value of being closely defined and comparable.

STORY OF BRIDGES. By A. Black. New York, McGraw-Hill Book Co. (Whittlesey House), 1936. 226 pp., illus., 9 × 6 in., cloth, $2.50.

This is an illustrated story featuring the romance of bridge building for the lay reader. The development of the bridge through the ages is described, and the problems, successes, and failures of bridge builders are narrated. Unusual bridges are given attention, and many outstanding modern structures are included. The volume is illustrated with photographs.

WATER TREATMENT AND PURIFICATION. By W. J. Ryan. New York and London, McGraw-Hill Book Co., 1937. 242 pp., illus., diagrs., charts, tables, maps, 8 × 6 in., cloth, $2.50.

The aim of this book is to describe, in a single volume, the several processes of purification and treatment that are applied to water. The construction and operation of the different types of filtering, softening, and treating apparatus are described concisely, yet clearly, and lists of articles affording further data are given. The book is a convenient summary of practice.

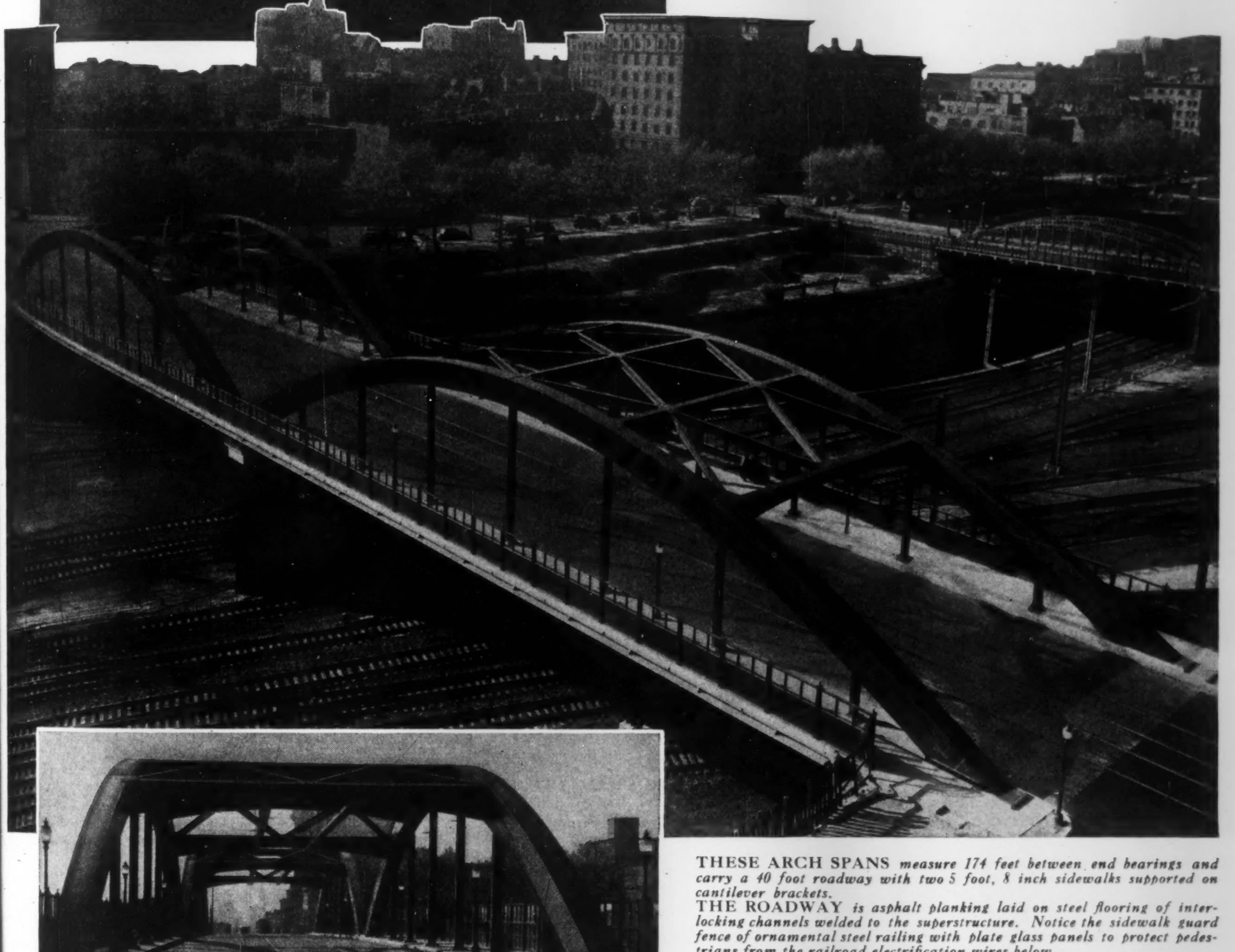
ZONING, the Laws, Administration, and Court Decisions During the First Twenty Years. By E. M. Bassett. New York, Russell Sage Foundation, 1936. 275 pp., 9 × 6 in., cloth $3.

The origins, legal development, and present status of zoning are discussed by an authority on the subject. An extensive review of court decisions upon every problem connected with zoning adds great value to the book. A bibliography on zoning in this country, from 1903 to 1936, is included.

STURDY ARCHES OF STEEL *enhance* BALTIMORE BRIDGE

STRUCTURAL steel's adaptability to esthetic treatment is again shown by the Guilford Avenue Bridge in Baltimore. These new twin spans, of the 3-hinged tied-arch type, replace an old bridge consisting of two Warren-type trusses with cast iron top chords and eyebar bottom chords.

The complete finished structure was contracted for by American Bridge Company. This included fabrication and erection of all structural steelwork, construction of concrete substructure, piers, roadway and sidewalk decks and railing—as well as removal of the old structure. This was satisfactorily carried out under the hazards of uninterrupted train traffic on the electrified system below.



THESE ARCH SPANS *measure 174 feet between end bearings and carry a 40 foot roadway with two 5 foot, 8 inch sidewalks supported on cantilever brackets.*
THE ROADWAY *is asphalt planking laid on steel flooring of interlocking channels welded to the superstructure. Notice the sidewalk guard fence of ornamental steel railing with plate glass panels to protect pedestrians from the railroad electrification wires below.*

Built by Maryland State Road Commission for City of Baltimore under direct supervision of H. E. Tabler, Chairman, Nathan L. Smith, Chief Engineer, and Walter C. Hopkins, Bridge Engineer. Design developed by Engineering Department of the City of Baltimore, B. L. Crozier, Chief Engineer and H. F. Lucke, Jr., Associate Engineer.

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UNITED STATES STEEL

CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

Concrete Reinforcement, Welding. Welding Applied to Reinforced Concrete Structures, O. Bondy. *Welding Engr.*, vol. 21, no. 11, Nov. 1936, pp. 24–27. Report deals only with principles of welding design as far as reinforced concrete is concerned, and with details of number of concrete bridges erected in Belgium with arc-welded reinforcing bars; in field of concrete buildings, 1935's World Exhibition at Brussels gave some idea of possibilities. Bibliography.

Design. Some Recent Developments in Bridge Design, P. G. Martin. *Kansas Eng. Soc.—Year Book*, 1936, pp. 24–29. Review of developments and their relation to recent state highway public works program.

Highway, Africa. Recent Progress in Road Bridge Design in Tanganyika Territory, A. J. Mitchell. *Structural Engr.*, vol. 14 (new series), no. 6, June 1936, pp. 270–281. Design features, construction, and cost of wooden, concrete, and steel bridges and viaducts in Tanganyika Territory, in Africa.

Highway, Approaches. Unusual Asphalt Paving on Bay Bridge Approach Route. *Western Construction News*, vol. 11, no. 8, Aug. 1936, pp. 249–251. Special features of highway project under construction, to provide facility to carry heavy volume of traffic from East Bay area to San Francisco–Oakland Bay Bridge; surfacing 4 in. thick designed for road bed of hydraulic fill; mix has high asphalt to obtain flexibility; contractor's plant equipped to eliminate dust and conserve fines.

Railroad. Meeting Specific Problems in Bridge Design, R. P. Hart. *Ry. Age*, vol. 101, no. 26, Dec. 26, 1936, pp. 936–938. Importance of design features of small bridges; adaptations of three-pile concrete bent; use of steel piles, wooden trestle, and concrete rigid-frame types.

Railroad, Maintenance and Repair. Bridge Men Discuss Problems at Annual Meeting. *Ry. Eng. & Maintenance*, vol. 32, no. 11, Nov. 1936, pp. 701–736. Proceedings of meeting of American Railway Bridge and Building Association and following papers and reports: Relative Merits of Different Species of Wood for Timber Bridges; Adapting Bridge Maintenance Methods to Today's Requirements for High-Speed Train Service; Preframing Timber Bridges; Underwater Repairs to Bridge Piers and Abutments; Maintenance of Railway Roofs; Protecting Steel Bridges Against Brine Drippings; Inspection and Maintenance of Water Tanks.

Steel Arch, Oregon. Building Yaquina Bay Bridge on Oregon Coast Highway, M. E. Reed. *Western Construction News*, vol. 11, no. 5, May 1936, pp. 133–136. Construction of Yaquina Bay highway bridge near Newport, Ore., consisting principally of seven arch spans totaling 3,260 ft in length, including main steel arch span 600 ft long, which was erected with cable tie-backs and no falsework; foundation construction; fender piling; pier design; cost data.

Steel Arch, Sweden. Les Nouveaux ponts de Stockholm, N. E. W. Nilsson. *Ossature Métallique*, vol. 15, no. 4, Apr. 1936, pp. 169–176. Features of three long-span steel-arch bridges in Stockholm, Sweden: Traneberg, Vaesterbron, and Paalsund.

Steel, St. Charles, Mo. Wabash Completes New Missouri River Crossing at St. Charles. *Ry. Age*, vol. 101, no. 23, Dec. 5, 1936, pp. 821–824. Structural details of four-span, single track, railroad bridge over Missouri River, at St. Charles, Mo.; channel span is 624 ft long with two cantilever anchor arms, 274 and 431 ft, respectively; viaduct approach is 3,945 ft long of steel-girder type with towers using H-column sections.

Steel Truss, Egypt. Die neue Strassenbruecke ueber den Nil bei Benha (Aegypten), F. Sperber. *Bautechnik*, vol. 14, nos. 13 and 15, Mar. 20, 1936, pp. 200–202 and Apr. 3, pp. 222–224. Design and construction of 5-span steel-truss highway bridge, 260 m long, exclusive of approaches, over Nile River at Benha, Egypt; sinking of shafts for masonry bridge piers; erection of steel superstructures.

Steel Truss, Montana. Montana Adds Two Bridges on Important Highway Route, R. A. Stephenson. *Western Construction News*, vol. 11, no. 8, Aug. 1936, pp. 246–248. Construction of Columbia Falls and of Kalispell steel-truss bridges over Flathead River in Montana; 500 ft and 900 ft in length, respectively; construction procedure during severe winter weather; cost data.

Steel Truss, Oregon. Cantilever Erection Plan Is Feature of Coos Bay Bridge. *Western Construction News*, vol. 11, no. 7, July 1936, pp. 224–227. Construction of steel-truss highway bridge having main span 793 ft long and totaling 5,337 ft in length; main span has vertical clearance of 145 ft; bridge, crossing Coos Bay harbor, 230 miles north of Portland, Ore., comprises 13 concrete-arch deck spans varying from 157 to 265 ft in span.

Suspension, Panama. Bridging Rio Chiriqui on Pan-American Highway, C. B. McCullough. *Eng. News-Rec.*, vol. 117, no. 22, Nov. 26, 1936, pp. 757–759. Design and construction of 400-ft span cable suspension bridge with unloaded backstays crossing Rio Chiriqui, in Republic of Panama; structural details.

Suspension, San Francisco–Oakland Bay. San Francisco–Oakland Bay Bridge, G. B. Woodruff. *Western Machy. & Steel World*, vol. 27, nos. 6 and 11, June 1936, pp. 197–199, and Nov., pp. 378–382. June: Details of suspension ropes, sockets, and method of connecting with deck structure; November: Machine used in various fabrication and construction operations.

Wooden, Maintenance and Repair. Union Pacific Adopts New Methods in Bridge Maintenance and Renewals. *Ry. Eng. & Maintenance*, vol. 32, no. 12, Dec. 1936, pp. 791–794. Program of maintenance and renewals for wood bridges, trestles and ties, and guard timbers of steel bridges.

CITY AND REGIONAL PLANNING

Housing, United States. Proceedings of Conference on Low Cost Housing Held at Pennsylvania State College, April 16 and 17, 1936. *Pa. State College—School Eng.—Tech. Bul.*, no. 23, vol. 30, no. 36, Sept. 5, 1936, 103 pp., 3 supp. sheets. Price 50 cents. Record of proceedings including following papers and discussions: Interrelation of Industrial Decentralization and Housing, N. H. Engle; Taxation as Factor in Housing for Low-Income Groups, H. S. Buttenheim; Economics of Low Rent Housing, C. E. Pynchon; Analysis of Housing Problem of Low-Income Groups, A. C. Holden; Rôle of Government in Housing, J. S. Taylor; Organization of Cooperative Housing for Workers, E. E. Wood; Housing by Employers in United States: Problem of Company Towns and Company Housing, L. Magnusson; Construction Materials for Low Cost Housing, A. S. McAllister.

Sicily. Il piano regolatore di Aprilia, R. Carlo. *Ingegnere*, vol. 14, no. 4, Apr. 1936, pp. 177–210. Review of prize-winning plans submitted in competition for development of new town of Aprilia in reclaimed Pontine marshes on west coast of Italy.

CONCRETE

Construction, Forms. Construction Design Chart, J. R. Griffith. *Western Construction News*, vol. 11, no. 7, July 1936, p. 239. Alignment charts for design of joists supporting form sheathing; allowable span for deflection.

Grandstands. Pumping Grandstand Concrete in Cold Weather, E. D. Roberts. *Eng. News-Rec.*, vol. 117, no. 21, Nov. 19, 1936, pp. 711–712. Placing concrete during extreme cold weather by pumping method in construction of additional grandstands at Navin Field ball park, Detroit; stands were enclosed in canvas housing and heated by unit heaters during construction.

Mixing. Grundlagenforschung zur Betontheorie von Duff A. Abrams and G. Kathrein. *Zement*, vol. 25, nos. 39 and 40, Sept. 24, 1936, pp. 682–686, and Oct. 1, pp. 698–704. Study of principles underlying D. A. Abrams' theory of concrete; influence of properties of aggregates in determining best composition of concrete; contribution to morphology of aggregates; sieve analysis of particle size and shape distribution of different granular materials; system of particle shape classification recommended. Bibliography.

Tile. Improving Drain Tile Resistance to Alkali Conditions, D. G. Miller. *Agric. Eng.*, vol. 17, no. 12, Dec. 1936, pp. 513–515, and 544. Results of observations of experimental specimens subjected to artificial sulfate solutions in laboratory and to behavior of specimens under natural field exposure conditions; over 60,000 cylinders, 2 by 4 in., and 4,000 specially made tile examined. Before Am. Soc. Agric. Engrs.

DAMS

Boulder Dam Project, Construction Camps. Building of Boulder City, E. H. Heinemann. *Reclamation Era*, vol. 26, no. 5, May 1936, pp. 110–112. Housing and feeding of men employed in Boulder Dam construction; employees' homes; recreation and transportation; fire-fighting equipment.

Compressed Air. Compressed Air at Grand Coulee Dam, H. W. Young. *Compressed Air Mag.*, vol. 41, no. 12, Dec. 1936, pp. 5184–5189. Examples of utilization of compressed air in construction of dam.

Concrete Arch, Buchanan, Texas. Buchanan Dam, G. W. Morrison. *Compressed Air Mag.*, vol. 41, no. 11, Nov. 1936, pp. 5157–5163. Plan and construction operations of L-shaped multiple-arch dam 11,200 ft long, over Colorado river, consisting of 29 reinforced concrete arches, each with span of 70 ft and maximum height of 160 ft.

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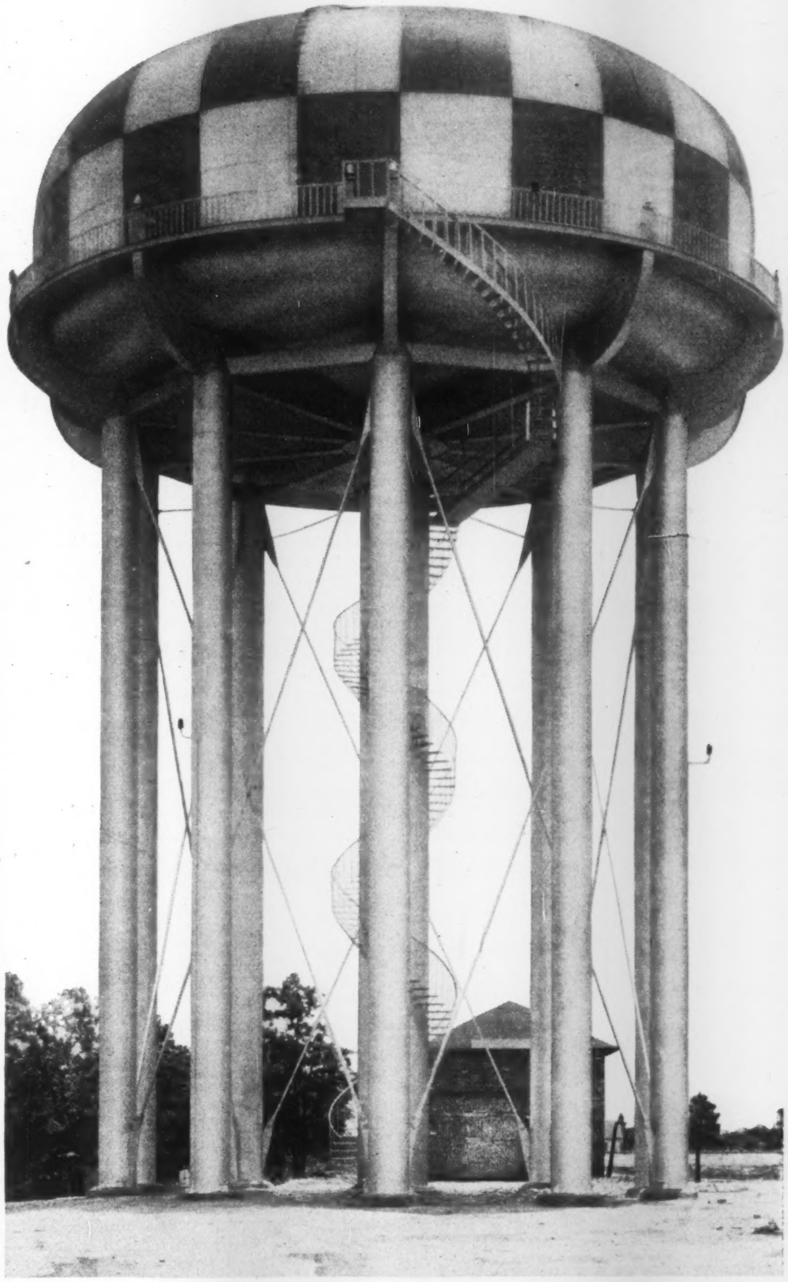

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PLANTS in BIRMINGHAM, CHICAGO, and GREENVILLE, PENNA.

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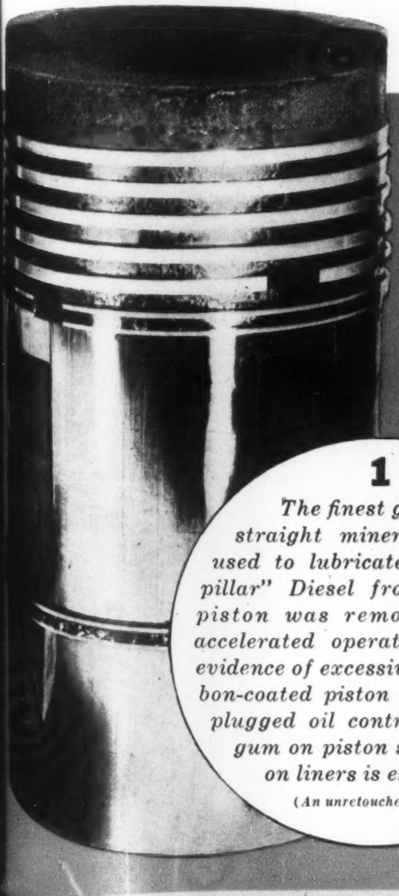
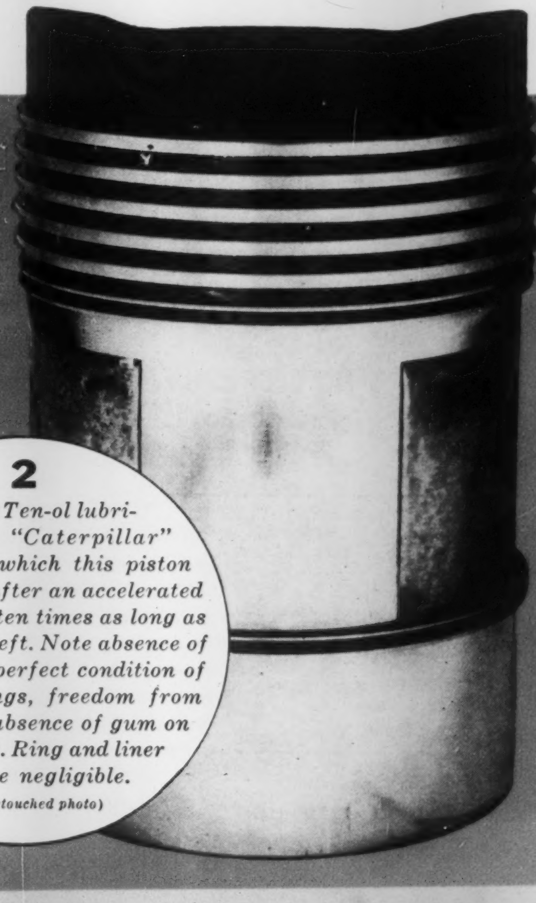


1

The finest grade of straight mineral oil was used to lubricate the "Caterpillar" Diesel from which this piston was removed after an accelerated operation test. Note evidence of excessive blow-by, carbon-coated piston crown, sludge, plugged oil control rings and gum on piston skirt. Wear on liners is excessive.

(An unretouched photo)



2

Sinclair Ten-ol lubricated the "Caterpillar" Diesel from which this piston was removed after an accelerated operation test ten times as long as the one on the left. Note absence of ring sticking, perfect condition of oil control rings, freedom from blow-by and absence of gum on piston skirt. Ring and liner wear are negligible.

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LAND RECLAMATION AND DRAINAGE

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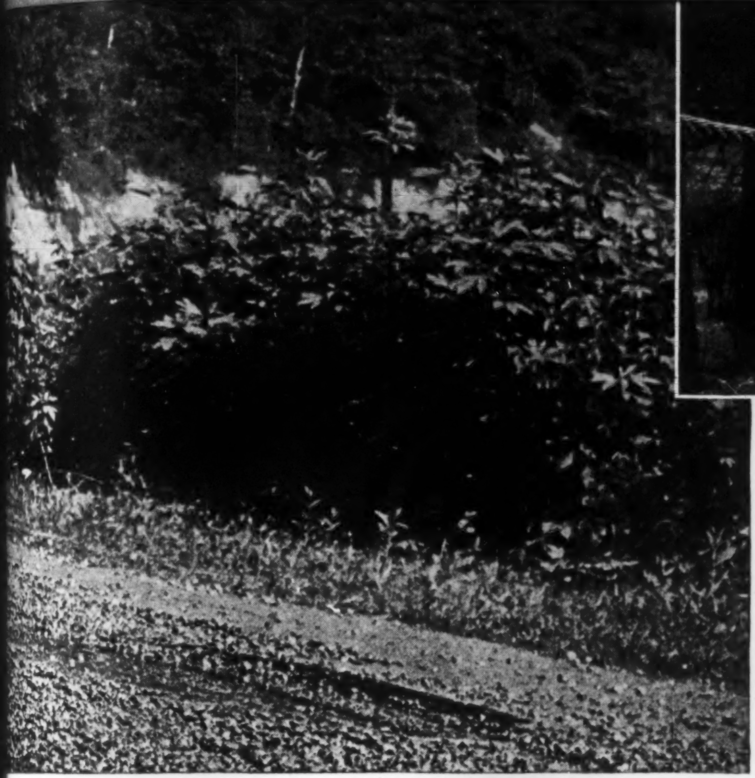
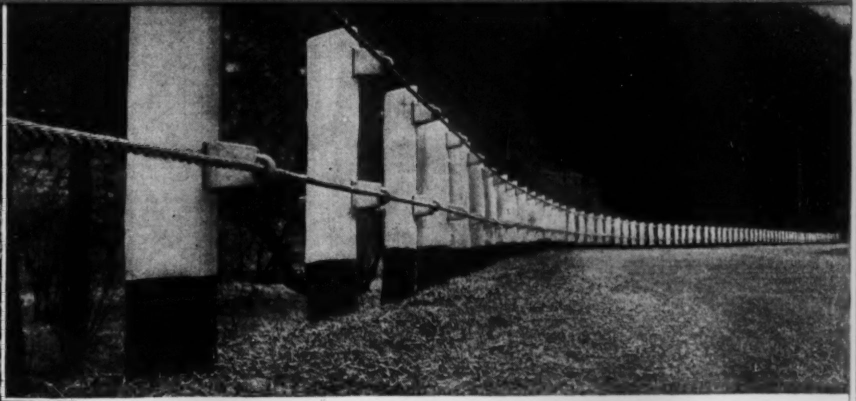
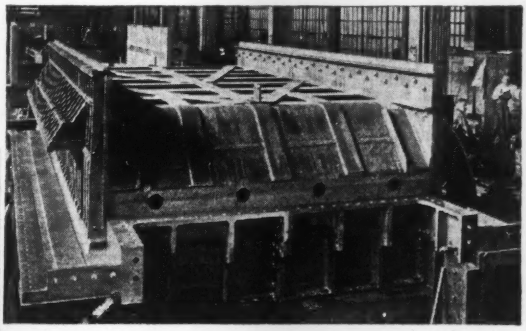


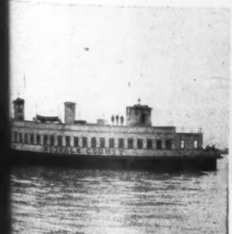


THESE CREOSOTED POSTS ARE PAINTED WITH LUMINO—Lumino is a bituminous base paint containing Alcoa Albron Aluminum Powder. As it is applied, the tiny flakes of aluminum "leaf" to the surface, forming an overlapping metal protection. The bituminous vehicle forms a strong bond between the creosoted surface and the aluminum metallic film. The aluminum gives a bright, highly-visible and attractive appearance to creosoted guard rails, posts, wheel guards and other timber. Koppers also handles a complete line of paints, for metal and for wood, including waterproofing and decorative paints.

S TARMAC BEING USED IN MIXED-IN-PLACE CONSTRUCTION IN PENNSYLVANIA—In
-in-place Construction (coarse aggregate type) hot-application Tarmac
g a float test of 60 to 150 or 150 to 210 seconds at 32° C.) is gradually
nting the use of heavy cold-application tars for warm-weather use. By
ng the hot Tarmac in one application rather than two, the mixing cost is
d one third without sacrificing thorough mixing. The use of hot Tarmac
a surface with greater initial stability and permits quicker application of the
oats. For work in cool
r, heavy cold-applica-
Tarmac is preferred.
o shows wedge course of
d Tarmac being bladed
rimed concrete surface)



BARTLETT HAYWARD DIVISION, BALTIMORE, DEVELOPS KOPPERS D-H-S BRONZE AND, FOR THE FIRST TIME, BRONZE IS USED IN TUNNEL LININGS—This photograph shows one of the tractor gates (partially assembled) for the Emergency Gate Shafts at the Fort Peck Dam. On this project there is to be used 350,000 lbs. of D-H-S Bronze and 1,200,000 lbs. of B. H. Manganese Bronze Castings. D-H-S Bronze combines the highest Ductility, Hardness and Ultimate Tensile Strength.



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HILER ENGINEERING AND CONSTRUCTION COMPANY, INC.	PITTSBURGH, PA.
AMERICAN HAMMERED PISTON RING DIVISION	BALTIMORE, MD.
THE KOPPERS COAL COMPANY	PITTSBURGH, PA.
THE MARYLAND DRYDOCK COMPANY	BALTIMORE, MD.
THE WHITE TAR COMPANY OF NEW JERSEY, INC.	KEARNY, N. J.

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PLANTS, DESIGN. Design and Operation of Sewage-Disposal Plants for Small Municipalities, W. B. Redfern. *Can. Engr.*, vol. 71, no. 14, Oct. 6, 1936, pp. 48, 50, 52, 54, 56, 58, and 60. List of treatment plants in Ontario, Canada, giving type, capacity, and equipment; design fundamentals.

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PLANTS, SWITZERLAND. Die Klaeranlage der Stadt Zuerich im Werdhoelzli, J. Mueller. *Schweizerische Bauzeitung*, vol. 107, nos. 18 and 19, May 2, 1936, pp. 193–195, and May 9, pp. 205–206. Design, construction, and equipment of new Werdhoelzli sewage disposal plant of city of Zurich, Switzerland, designed for capacity of over 2,000 liters per sec; sludge digestion and gas recovery.

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SEWERS, LINING. Repairing and Lining Old Sewer in Indianapolis, M. G. Johnson. *Pub. Works*, vol. 67, no. 12, Dec. 1936, pp. 17–18. Method used to repair and line sewer while in use as combination sanitary and storm sewer.

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WATER POLLUTION, OREGON. Industrial and Domestic Wastes of Willamette Valley, G. W. Gleeson and F. Merryfield. *Ore. State Agric. College—Eng. Experiment Station—Bul., Series No. 7*, May 1936, 63 pp. Abridged report of technical committee on pulp and paper trade wastes; pollutional strength of various industrial and domestic wastes; flax retting wastes; tannery and meat packing wastes; woolen mill wastes; experimental study of effect of aeration of sulfite liquor.

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BEAMS, CONCRETE. Die Bruchspannungen und die zulaessigen Randspannungen in rechteckigen Eisenbetonbalken, A. Brandtzaeg. *Beton u Eisen*, vol. 35 no. 13, July 5, 1936, pp. 219–222. Results of, experimental study, made at Trondhjem Institute of Technology, Norway, on distribution of stresses and ultimate strength of reinforced concrete beams of rectangular cross-section; safety factors; determination of allowable stresses.

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AQUEDUCTS, LOS ANGELES. Los Angeles Taps Mono Basin Water by Means of 11.5-Mile Tunnel. *Western Construction News*, vol. 11, no. 6, June 1936, pp. 170–172. Increasing flow of Owens Valley aqueduct of Los Angeles water works to its capacity of 480 cu ft per sec by water collected from streams in Mono Basin and diverted through Mono Craters tunnel; new Long Valley reservoir will regulate this supply above head of aqueduct; Mono Craters tunnel, 59,812 ft in length, is of 9-ft section, wide horseshoe type, and will be concrete lined throughout.

WATER RESOURCES

UNDERGROUND, NEW ENGLAND. Geologic Features in New England Ground Water Supply, K. Bryan. *New England Water Works Assn.—J.*, vol. 50, no. 2, June 1936, pp. 222–228. Survey of geological data; sources of ground water; sand and gravel formed as result of glaciation; glacial phenomena in New England; relation of glacial history to weathering.

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SOFTENING. Adapting Water Softening Plant to Small Community, H. H. Connell. *Kansas Eng. Soc.—Year Book*, 1936, pp. 40–46. Chemical or lime-soda softening; zeolite softening; combination treatment.

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DISTRIBUTION SYSTEMS, BIRMINGHAM, ALA. New Industrial Water Supply System at Birmingham, Ala., A. C. Decker. *Pub. Works*, vol. 67, no. 12, Dec. 1936, pp. 20–22. Progress on WPA project, including construction of rock-fill dam 200 ft high, 184-ft spillway, and 30 miles of pipe line.

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MAINTENANCE AND REPAIR. When Mercury Flirts with Zero, W. W. Brush. *Water Works Eng.*, vol. 89, no. 26, Dec. 23, 1936, pp. 1654–1659. Procedure to follow in preventing costly inconveniences caused by severe cold weather.

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RESERVOIRS, PARKS. Reservoir Roofs Utilized for Park and Recreation, A. Taylor. *Western Construction News*, vol. 11, no. 6, June 1936, pp. 188–189. Utilization of roofs of two covered water distribution reservoirs in Beverly Hills, Calif., for tennis courts, park, etc.

LLIS-CHALMERS OWNERS REPEAT

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Repeat orders are the best testimonials! When the Controlled Ignition Oil Tractor was introduced—it answered what engineers had called the greatest tractor need of the day—the economy of Diesel fuel oil COMBINED with the flexibility, instant starting, balance, reliability and all-round performance of gasoline models. Probably the best evidence that Controlled Ignition met a real need is the expression of Oil Tractor owners—with repeat orders. The first contractor owner of Oil Tractors has since standardized on A-C Controlled Ignition. So has the first county purchaser of Controlled Ignition. And so have hundreds of other Allis-Chalmers owners everywhere. There's a reason for this expression of user satisfaction. Let the A-C dealer show you.

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WINNEBAGO COUNTY "REPEATS"

First purchaser of current model Oil Tractors was Winnebago county, Ill., in January, 1936. They bought the first three Controlled Ignition Model "L-O's"—two of which are shown here with Continental scrapers. In need of an additional tractor recently, nothing else would do but another Model "L-O". Controlled Ignition owners repeat!

Controlled Ignition OIL TRACTORS

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

New Caterpillar Graders

Two NEW blade graders, in 12 ft and 10 ft sizes, have been added to the "Caterpillar" grader line. These new models have single member frames and will be known as No. 66 Single Frame and No. 44 Single Frame, since they are in the same weight classes as the No. 66 and No. 44 Double Frame models. They are offered in both power and hand control.

These new machines are designed particularly for combination work in which quick movement of the blade from ditching position to the high rank cutting position is important. With the power controlled models less than one minute is required to move the blade from one position to the other, and with any of the models this may be done without offsetting the blade on the blade arms, or making any changes in lifting or lateral shift links.

The single frame members are made of two ship channels, 9 in. on the No. 66, and 8 in. on the No. 44. These two channels are about 4 in. apart in the center, and a steel plate is welded over the top and bottom of both channels, forming a box type frame member, about 11 in. wide with great strength and rigidity. Immediately back of the blade arm mounting, the frame channels separate and form two members, each a box section having plates welded between the channel flanges. This construction provides unusual frame strength, yet does not obstruct blade visibility. Both blade lift links are of the telescopic type and may be quickly extended for securing the most extreme blade positions for unusual jobs.

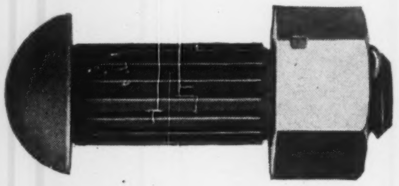
Oxweld Announces Three New Regulators

A SERIES of three new regulators providing accurate oxygen and acetylene regulation through the entire range of welding and cutting operation has just been announced by The Linde Air Products Company. All three regulators are of two-stage construction, essentially identical in basic design, and offer the utmost in precise, efficient pressure control.

The Oxweld Type R-64 oxygen regulator is designed to operate with extreme precision in all welding and cutting operations requiring oxygen pressures up to 75 lb per sq in. The Oxweld Type R-65 oxygen regulator is designed for heavy-duty cutting operations, which may require oxygen pressures as high as 200 lb per sq in. As the sensitivity of adjustment and precision of operation carry throughout its entire pressure range, it can also be used for welding, should the need arise. The Oxweld Type R-66 acetylene regulator is a companion piece for either of the oxygen regulators and will give accurate acetylene regulation for all welding and cutting.

Structural Rib Bolt

BOLTS OF carbon manganese steel, with automatic lock nuts, are offered as practical substitutes for rivets by the Automatic Nut Co., Inc., Lebanon, Indiana.



The shank of the bolt carries triangular ribs which are claimed to embed themselves in the wall of the hole in the work.

Bolts and nuts, with U. S. standard threads, are made in six diameters, from $^{3}/_{8}$ in. to 1 in., and in a wide range of lengths from $1^{1}/_{16}$ in. to $5^{5}/_{16}$ in. Descriptive literature will be furnished by the manufacturer.

Crawler Wagon Scrapers

THE TRACTOR Equipment Division of the Continental Roll & Steel Foundry Co., East Chicago, Indiana, announces a line of wagon scrapers mounted on crawlers.

The maker claims that equipping wagon scrapers with crawlers allows for their use more days a year, as the crawlers provide ample traction and load carrying ability during a greater part of the wet season and allow for operation in wet soils and under adverse conditions.

According to the report, the use of crawler units in no way affects the efficiency or speed of operation of Continental Wagon Scrapers; in some cases, their use actually lessens the load on the tractor. All sizes of Continental Wagon Scrapers —5, 7, and 10 yd models—are available with crawler units; the 10 yd unit being available for field replacement on Continental Wheeled Wagon Scrapers now in the field.

Carry Scrapers

A SIMPLIFIED design of their carry scraper is announced by the Southwest Welding & Manufacturing Co., Alhambra, California. Capacities remain at 6, 8, 10, and 12 cubic yds, but the frame structure has been changed from the I-beam type to the welded box type, giving added strength with less weight, and eliminating projections for the accumulation of dirt. The revolutionary feature of the former design is the central pivot construction that reduces the power demand on the tractor, and, in the cable type, materially lengthens the life of the cables. This feature has been retained and improved.

Low-Cost Asphalt Roads

A PUBLICATION entitled "Asphalt Roads—Intermediate Types" furnishes information on the various low-cost types of Texas Asphalt Surfacing.

With the aid of appropriate photographic illustrations the booklet discusses road-mix construction with Texaco Surfacing Material, plant-mix construction with Texaco Surfacing Material, Surface Treatment with both Texaco Surfacing Material and Texaco Asphalt Cement, and dust laying with Texaco Surfacing Material.

Tables cover quantities of surfacing material, stone, and sand required per mile of road of various widths. Copies will be furnished by The Texas Co., 135 East 42nd St., New York, N.Y.

The "QX" Series Engines and Power Units of Hercules

THE HERCULES MOTORS CORPORATION of Canton, Ohio has added the following models to their present line of the "QX" series of modern heavy duty four and six cylinder engines.

Model	Bore	Stroke	Displacement
"QXA"	$3^{1}/_{8}$	$4^{1}/_{8}$	190
"QXB"	$3^{1}/_{4}$	$4^{1}/_{8}$	205

These two models are identical in general design and appearance and the majority of the parts are interchangeable, the only difference being in the bores and the parts affected thereby.

The maximum torque of the "QXA" is 130 ft lbs at 1,000 R.P.M. and of the "QXB" is 135 ft lbs at 1,000 R.P.M. Both models peak at 3,000 R.P.M. at which speed the "QXA" develops 55.5 hp and the "QXB" develops 60 hp.

To meet present day operating conditions calling for a sustained high speed, special consideration has been given to the valve cooling and water completely surrounds the valve seats. Full packless engine lubricated water pumps are supplied on these engines, making it unnecessary for the operator to periodically adjust glands or add grease.

The engines are equipped with a No. 5 SAE bellhousing and flywheels can be furnished for any standard make of clutch which can be installed in a No. 5 housing. Down draft and up draft manifolds are both available.

The overall length of the standard "QX" series engines from the rear of the bellhousing to the front of the fan blade is $35^{1}/_{16}$ in. The height from the bottom of the bellhousing to the top water outlet pad on the cylinder head is $16^{3}/_{4}$ in. These dimensions are subject to slight variations due to different types of bellhousings and oil pans and fan assemblies which might be required for special applications.

U·S·S WIRE FABRIC can be *Economically used* in Every Building

WHEN a new building is being constructed or an old building remodeled, one or more places can be found where American Steel & Wire Company Wire Fabric can be used to give the additional strength that will put off the day when repairs will be necessary.

Our Wire Fabric for concrete reinforcement is made in triangle mesh or electric welded square or rectangular mesh. It can be furnished either in rolls or in flat sections to suit your particular requirements.

This product can be adapted to serve many purposes such as reinforcement for concrete floors, roofs and walls. You will find that our Wire Fabric is easy to put in place and there is the added advantage of economy when this product is used.

We will be glad to show you how our product can be used to your advantage in producing more durable concrete construction economically.

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United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

"Tarmac" Handbook

A 70 page handbook containing complete tables and useful general information relative to the use of Tarmac for road construction and maintenance has just been issued for free distribution by Koppers Company's Tar and Chemical Division, Pittsburgh, Pa.

The book also contains a discussion of methods and advantages of soil stabilization with Tarmac, condensed specifications for various methods of using road tars, and tables of data not previously issued in handbook form. There also is a list of other Koppers products for the highway and public works field such as crack filler, paving pitch, traffic marking paint, dampproofing and waterproofing materials, old style pitch and approved felt for roofing, kolineum, Grade 1 creosote, koleener, weed killers, disinfectants, municipal incinerators, Fast's couplings, fire hydrants, water works gate valves, dam gates, treated timber, American hammered piston rings, gas holders, and welded and riveted pipe.

New Street Lighting Unit

A new, highly efficient and attractive street lighting luminaire has recently been announced by the Westinghouse Electric & Manufacturing Company. Radically new in design the Relectolux Jr. Luminaires distribute light evenly along the street by means of carefully designed reflectors and bi-flectors made of specular, Alzak processed aluminum. Completely dust and weatherproof and easy to relamp and maintain, these modern luminaires make an economical and attractive street lighting unit.

The luminaire consists essentially of a canopy, reflector, globe holding ring, and globe. The light center of the lamp is $1^3/_4$ in. above the bottom of the main reflector, thus producing a sharp cut-off below the horizontal. The overall height of the Reflectolux Jr. is $22^3/_4$ in., while its overall diameter is $13^5/_8$ in.

Facilities for mounting a series socket and receptacle, mogul multiple or medium multiple sockets are provided inside of the canopy. Where different types of circuits are operated by the same supervision, this latter arrangement will be appreciated as it materially reduces the number of parts required for stocking, and makes the appearance of the luminaires on the various circuits identical. The canopy is fitted with three pins which slide in the bayonet slots of the reflector heel.

A New Line of Welders

The Harnischfeger Corporation of Milwaukee, Wisconsin, announces a new line of simplified P & H Hansen "Smootharc" welders featuring single current control, self-excitation, and internal stabilization. These welders are built in two styles, vertically mounted in 75, 100, and 150 ampere capacities, and horizontally mounted in 200, 300, 400, and 600 ampere sizes.

Folders Announced

Arc Welder. The Lincoln "Shield Arc SAE" welder, engine driven model, Type S-6005, 200 amperes, with its feature of dual continuous control, is illustrated and described in a 4-page, $8^1/_2$ by 11 in. folder. Lincoln Electric Co., Cleveland, Ohio.

Arc Welder. A new 40 volt Simplified Electric Arc Welder is illustrated and completely described, with specifications, in a 24-page, $8^1/_2$ by 11 in. booklet. Hobart Brothers Co., Troy, Ohio.

Batteries—The Goodrich line of batteries for tractors, trucks, and buses is presented in a new 24-page, $8^1/_2$ by 11 in. booklet. Battery power requirements; construction features; and complete battery specifications are described and pictured. B. F. Goodrich Company, Akron, Ohio.

Bolts and Screws of Everdur. The physical properties, constants, characteristics, and applications of bolts, screws, and accessories are thoroughly covered in tabulations and charts in an illustrated 16-page, $8^1/_2$ by 11 in. booklet. The American Brass Co., Waterbury, Connecticut.

Concrete Machinery—A pocket edition catalog describes and illustrates the entire line of mixers, pavers, collapsible tunnel forms, pneumatic placers, and grouters, etc., 28 pages, $2^1/_2$ by $6^1/_4$ in. Ransome Concrete Machinery Company, Dunellen, N.J.

Earth Handling Equipment. A pictorial catalog, No. 1655, features Austin-Western equipment in operation and gives brief specifications and reference data. 24 pages, $8^1/_2$ by 11 in. Austin-Western Road Machinery Co., Aurora, Illinois.

Hose. Rubber hoses for the industrial uses of air, water, welding, steam, oil, suction, etc., are described and illustrated in the 1937 catalog of 48 pages. United States Rubber Products, Inc., 1790 Broadway, New York, N.Y.

Industrial Packings. A manual on this subject covers sheet packings, gaskets, rod and plunger packings, hydraulic packings, flax and jute, locomotive and special oil well rotary drilling packings, pump valves, and miscellaneous packings. The 112-page manual also includes complete engineering data indicating the various characteristics of each packing. Several special sections are devoted to recommendation charts. A special twelve-page engineering section is devoted exclusively to charts listing specific gravities, the temperature of steam at different pressures, Fahrenheit Centigrade conversion table, metric conversion table, melting points of materials and their weights, and other useful data. United States Rubber Products, Inc., 1790 Broadway, New York, N.Y.

Manganese-Vanadium Steel. This alloy steel for plates and structural shapes, and for rivets is described and illustrated; with specifications; in a 16-page, $8^1/_2$ by 11 in. folder. Vanadium Corporation of America, 420 Lexington Ave., New York, N.Y.

Potentiometer. A new recording round-chart potentiometer known as the Pyromaster is described in bulletin No. 482. This bulletin contains drilling dimensions, chart lists, and other engineering data pertaining to the Pyromaster in the following forms: pyrometer, tachometer, resistance thermometer, millivoltmeter, and milliammeter. Bristol Co., Waterbury, Connecticut.

Pumps. A convenient pocket size, $4^3/_4$ by $8^1/_2$ in., "Pump Data" handbook of 256 pages lists the recommended sizes for the desired capacity and pumping head of the various classes of pumps manufactured. For each listing the efficiency, required horsepower, pump cost, motor and control costs have been tabulated. A second section, devoted to "Engineering Data" gives specific and detailed information on the hydraulics of pumping and other related technical information. Economy Pumping Machinery Co., 3431 West Forty-Eighth Place, Chicago, Illinois.

Rock Drill. Bulletin No. 2285, 6 pages, $8^1/_2$ by 11 in., pictures and describes the new 150 lb drifter—DA-35—which is claimed to be the fastest drill built by the manufacturer. Ingersoll-Rand Co., 11 Broadway, New York, N.Y.

Shovel—Bulletin X-11 presents all facts on Model 455, the Harnischfeger Shovel called the "Pacemaker." 12 pages, $8^1/_2$ by 11 in., illustrated. Harnischfeger Corporation, Milwaukee, Wis.

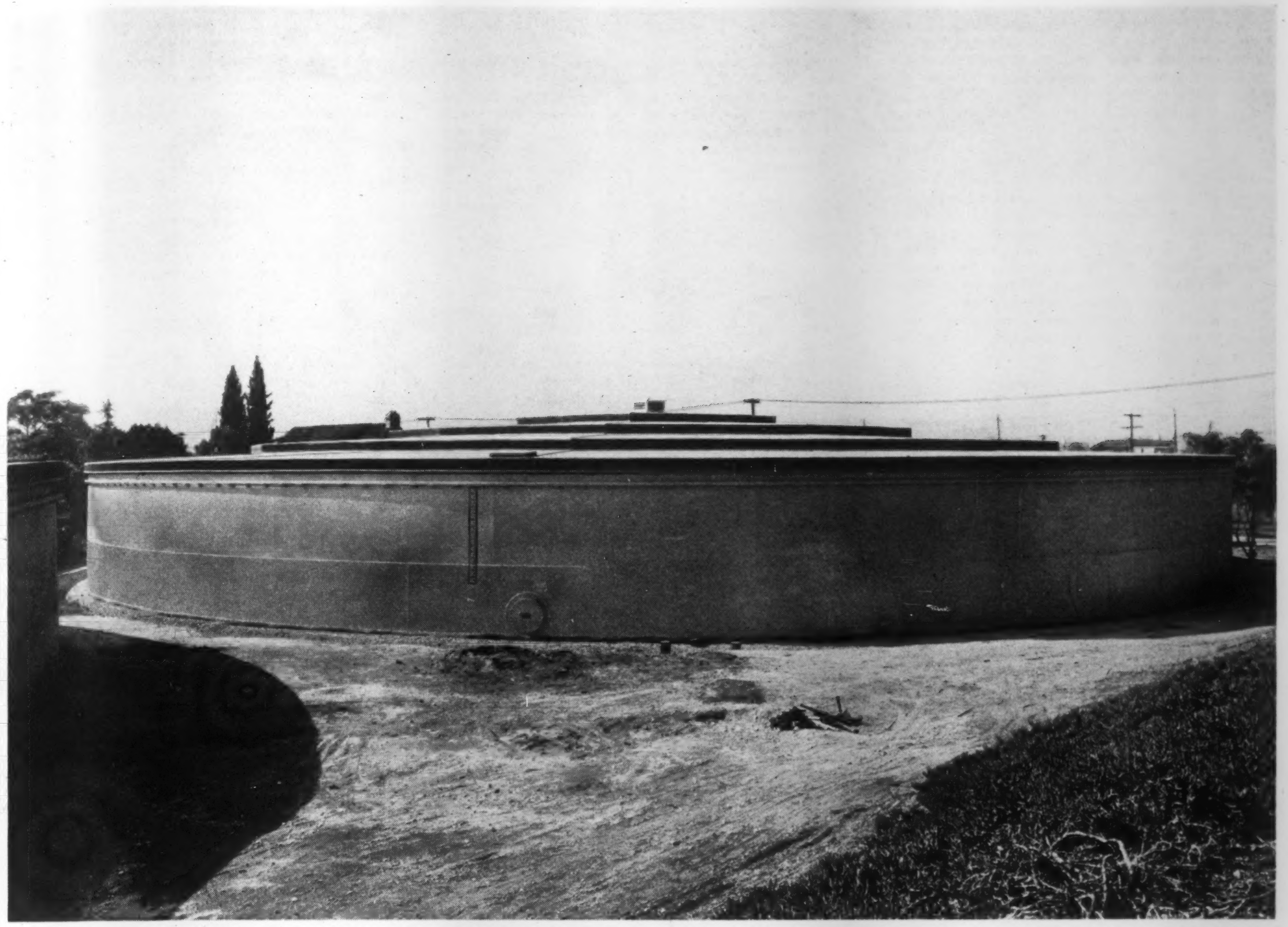
Shovel—"Race Horse Speed with Draft Horse Endurance," is the theme of a new 12-page book No. 1795 picturizing the advantages of Speed-o-Matic hydraulic power control of the mechanical operations of Link-Belt crawler shovels, draglines, and cranes. $8^1/_2$ by 11 in. Link-Belt Company, 300 W. Pershing Road, Chicago, Illinois.

Shovel—The Northwest, Model 80, $2^1/_2$ yd shovel is presented in an interesting booklet. The 24 pages of this $8^1/_2$ by 11 in. booklet carry full and double page illustrations of the buckets in use on outstanding projects; construction features of the shovel; and a table of Model 80 shovel's operating ranges. Northwest Engineering Company, 28 East Jackson Blvd., Chicago, Illinois.

Speed Reducers—Single and Double Reduction. Covering Types SH and DH, single and double reduction units of the single helical gear type, the Westinghouse Bulletin No. 25–030 describes the construction, design, efficiency, and rates of these units. $8^1/_2$ by 11 in., 8 pages, illustrated. Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

Surveying Instruments. A catalog of rebuilt surveying instruments lists various makes of factory reconditioned transits, alidades, convertible levels, level rods, and compasses; and also gives rental rates and conditions. 12 pages, $5^1/_2$ by $8^1/_2$ in., Warren-Knight Co., 136 N. 12th Street, Philadelphia, Pennsylvania.

Technical Coatings. Termed "Scientific Protection Against Corrosion" by the manufacturer, Technical Coatings are described in a 12-page, $8^1/_2$ by 11 in. booklet. The products, their services, tests, and costs are covered. Technical Coatings, 11 Park Place, New York, N.Y.



STEEL RESERVOIRS of welded construction FOR THE STORAGE OF WATER

Steel reservoirs provide an economical method of storing water at ground level in municipal waterworks systems, at industrial plants, institutions and other places where a reserve is desirable.

Steel reservoirs have long life. The material is impervious, eliminating seepage and consequent contamination of the water. The tensile strength of steel prevents cracks due to uneven settlement. Welded construction eliminates danger of leakage at joints.

Steel reservoirs are easy and inexpensive to maintain. The bottom plates are usually laid on concrete slab foundations, a ring wall or on a prepared earthen grade which provides adequate drainage. Where backfilling against a portion or all of the shell is required, modern coatings with a ring of crushed rock next to the steel for drainage protects the shell against corrosion. Exposed areas are adequately protected by regular painting.

Steel reservoirs are economical to build. The first cost is often lower than similar capacities of other materials and the annual cost is materially lower when the long life of steel and the low maintenance costs are figured in.

Steel reservoirs are pleasing in appearance. They can be designed to harmonize architecturally with surrounding structures and painted light color. Unsightly leaks do not appear to spoil the looks of the structure, regardless of age.

The above illustration shows one of two welded steel reservoirs recently completed for the municipal water system in Alhambra, Calif. They are 140 ft. in diameter and have a capacity of 2,300,000 gals. each. Note the modernistic design of the roof. Write our nearest office for information or quotation on steel reservoirs, storage tanks and steel plate work of all kinds.

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Chicago..............2199 Old Colony Bldg.
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Philadelphia.......1652-1700 Walnut Street
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Los Angeles............1456 Wm. Fox Bldg.

B-495

PLANTS in BIRMINGHAM, CHICAGO and GREENVILLE, PENNA.

Structural Engineer; Assoc. M. Am. Soc. C.E.; married; graduate; registered; over 20 years experience, bridges, buildings, sewage disposal, water filtration, rigid frames—6 years in charge of design, 5 years as superintendent of construction, 3 years teaching at University of Wisconsin. Desires permanent executive position, America or British Isles. D-5619.

Civil Engineer; M. Am. Soc. C.E.; 45; married; B.S.C.E., 1911, C.E., 1924, Georgia School of Technology; $25^{1}/_{2}$ years experience as engineer and executive; railroad construction, maintenance, valuation; practitioner before Interstate Commerce Commission; private practice, appraisals, investigations, inspections, reports, statistical studies, historical research, writing; senior administrative officer, U. S. Department of the Interior; engineer officer, U. S. Army. South preferred. Reasonable notice. D-5771.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 35; married; graduate civil engineer, 1924; Michigan license; 12 years progressive experience surveying, specifications, estimates, contracts, design of heavy and difficult hydraulic works and power structures, tunnels, pipe lines, sewers, railroad track layout, retaining walls, foundations, heavy buildings, roads, and highways. Capable of supervision. C-9870.

Civil Engineer; Assoc. M. Am. Soc. C.E.; Member, American Railway Engineering Association; C.E. degree; age 40; 18 years unusually broad experience, chiefly on railroad, with emphasis on design and analysis in reinforced concrete structures, also economic studies, estimates, reports. Producer, alert and practical. Readily adaptable to wide field of engineering practice. Prefer Rocky Mountain territory. D-3742.

Civil Engineer; M. Am. Soc. C.E.; excellent health; age 58; 33 years varied experience on works of magnitude. Qualified as construction engineer, superintendent of construction, chief engineer, executive on drainage, irrigation, highway, municipal, or hydroelectric work. Available in 30 days. Prefers West or South, but will go anywhere. C-1756.

Manufacturer's Representative; Assoc. M. Am. Soc. C.E.; registered engineer; 10 years experience and contacts in municipal and private construction, mines, chemical, and steel plants. At present employed as chief engineer in charge of design and construction together with engineering sales for Eastern manufacturer. Will consider a change. Prefers the West or foreign location. C-1.

Junior

Graduate Civil Engineer; Jun. Am. Soc. C.E.; 24; single; B.E., Vanderbilt University, 1934; 4 months as transitman, U. S. Coast and Geodetic Survey, control survey, field work, computing; 2 years planimetric aerial mapping, all phases of compilation, plotting, etc.; 2 months heating, plumbing design, drafting, piping, and layouts; desires design or planning engineering work with opportunity. D-5760.

Civil Engineer; Jun. Am. Soc. C.E.; age 26; B.S. degree, Bucknell University; single; desires position near Philadelphia. Experience in construction and operation of water works, drafting, and crew handling. Capable of doing sanitary engineering. Hard worker and efficient. Good reference. Will someone please give me a try? D-4921.

Civil Engineer; Jun. Am. Soc. C.E.; 27; single; B.S. in C.E.; graduate study in sanitary engineering; 4 years experience on water aqueduct, including supervision, inspection, surveying, estimating, and drafting. Responsible charge of WPA construction work for 14 months; now employed in civil service; desires change for position with more responsibility and opportunity. D-2319.

Graduate Civil Engineer; Jun. Am. Soc. C.E.; 24; B.S.E., C.E., Manhattan College; honor society; civil engineering medal; structural steel and concrete major; $2^{1}/_{2}$ years secretarial work (engineering school); $1^{1}/_{2}$ years instructing analytical mechanics, differential equations; 9 months with general contractor, estimating, surveying, drafting. Desires experience with consultant or engineering firm. Available in two weeks. D-4111.

Civil Engineer; Jun. Am. Soc. C.E.; 25; single; B.S.C.E., Armour Institute of Technology; member, Tau Beta Pi and Chi Epsilon; 6 months field work; 6 months aeronautic design; $1^{1}/_{2}$ years practical experience in experimental hydraulics—design, construction, operation, and preparation of reports relative to same. Hard worker. Desires connection with future. Location immaterial. Excellent recommendations. D-5808.

Sales

Structural and Sales Engineer; Assoc. M. Am. Soc. C.E.; 37; married; B.S. degree in engineering; 14 years experience in the fabrication of structural steel, including detailing, estimating, design, sales promotion, and in charge of fabricating plant. Central states preferable. Available on short notice. D-5813.

Stabilized Roads—Sales Engineer; M. Am. Soc. C.E.; now available; 4 years in development, sales promotion, and construction of one of the better known types of stabilized roads which has now attained national recognition. Responsible executive with experience in design and construction as well as sales. Speaks Spanish and Portuguese. B-3340-8911 Chicago.

Teaching

Professor; Assoc. M. Soc. C.E.; married; C.E. and A.B. degrees. Has specialized in structural design, steel, and reinforced concrete; 10 years practical experience in railroad location and construction; 9 years successful teaching experience in technical college. Contributor to technical press. D-5057.

Sanitary and Civil Engineer; Jun. Am. Soc. C.E.; age 29; C.E., M.S.; member of university faculty for 4 years; on staff of state sanitary research laboratory for 2 years; and with consulting sanitary engineering firm for 4 months At present supervising research on trade-waste disposal. Available July 1. C-4700.

Civil Engineer; Assoc. M. Am. Soc. C.E.; Society for Promotion of Engineering Education; age 39; 11 years experience, teaching civil engineering subjects, surveying, concrete design, structural analysis; 3 years responsible highway work. Now assistant professor in Midwestern college. Desires to improve position. D-4935.

Civil Engineer; Jun. Am. Soc. C.E.; 27; B.S.; M.S.; and C.E. Diversified experience, supervising hydraulic design of flood-control projects, teaching, and structural analysis. Advanced studies in elasticity, fluid dynamics, soil mechanics, mathematics, bacteriology, and water supply. Research in aeronautics, structures, and sewage disposal. University teaching and research position desired. D-4037.

Associate Professor—Engineer; Assoc. M. Am. Soc. C.E.; with 10 years practical experience in design of buildings and bridges; 3 years experience teaching structural engineering, theoretical and applied mechanics; desires to make teaching change. Has graduate and undergraduate degrees from leading universities. At present teaching above subjects in large university. Location East or South preferred. Available September 1937. D-1860.

Licensed Civil and Structural Engineer; Assoc. M. Am. Soc. C.E.; registered surveyor with 15 years experience in design and construction of various types of reinforced concrete structures; 7 years as sales engineer; desires position as sales engineer, reinforced concrete designer or design and construction, or instructor in concrete design in engineering school. Middle West preferred. D-5599.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 36; married; B.C.E. and C.E. degrees; Tau Beta Pi; Sigma Xi; Ohio license; 1 year teaching; 13 years practical experience in municipal, sanitary, hydraulic, and concrete work—9 years in responsible charge of design and preparation of plans. University faculty position desired. Interested in research and work towards advanced degree. D-5248.

Civil and Structural Engineer; Assoc. M. Am. Soc. C.E.; 38; married; graduate of University of Michigan, with B.Sc.C.E. degree; registered civil-structural engineer and land surveyor; 13 years practical experience in highway, municipal, structural, railroad, and valuation engineering. Would be interested in a teaching position. D-5523.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 42; B.S; M.S; C.E., 6 years teaching experience and 10 years as engineer of materials and research for state highway department. Desires to locate in development department of manufacturer of road or building materials or on engineering faculty of Western of Midwestern college or university. C-1642.

Structural and Hydraulic Design Engineer; Assoc. M. Am. Soc. C.E.; 31; married; B.S. and C.E. degrees; 8 years excellent experience in design of important structures. At present in responsible charge of design of a large hydroelectric project. Desires position teaching hydraulics and structural theory and design. D-5317.

Professor of Civil Engineering; M. Am. Soc. C.E.; licensed professional engineer; B.S. C.E., C.E.; major work for M.S. completed. Reinforced concrete, structures and highway; 15 years educational experience plus more than 10 years commercial work of major importance. Available as executive or professor of civil engineering. National officer in professional societies and active in publishing and committee work. B-7837.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1936. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

East Africa Plateaus and Rift Valleys. (Studies in Comparative Seismology). By B. Willis. Washington, Carnegie Institution of Washington, 1936. 358 pp., illus., diagrs., charts, maps, tables, 12 × 9 in., $4.25, paper; $5.25, bound.

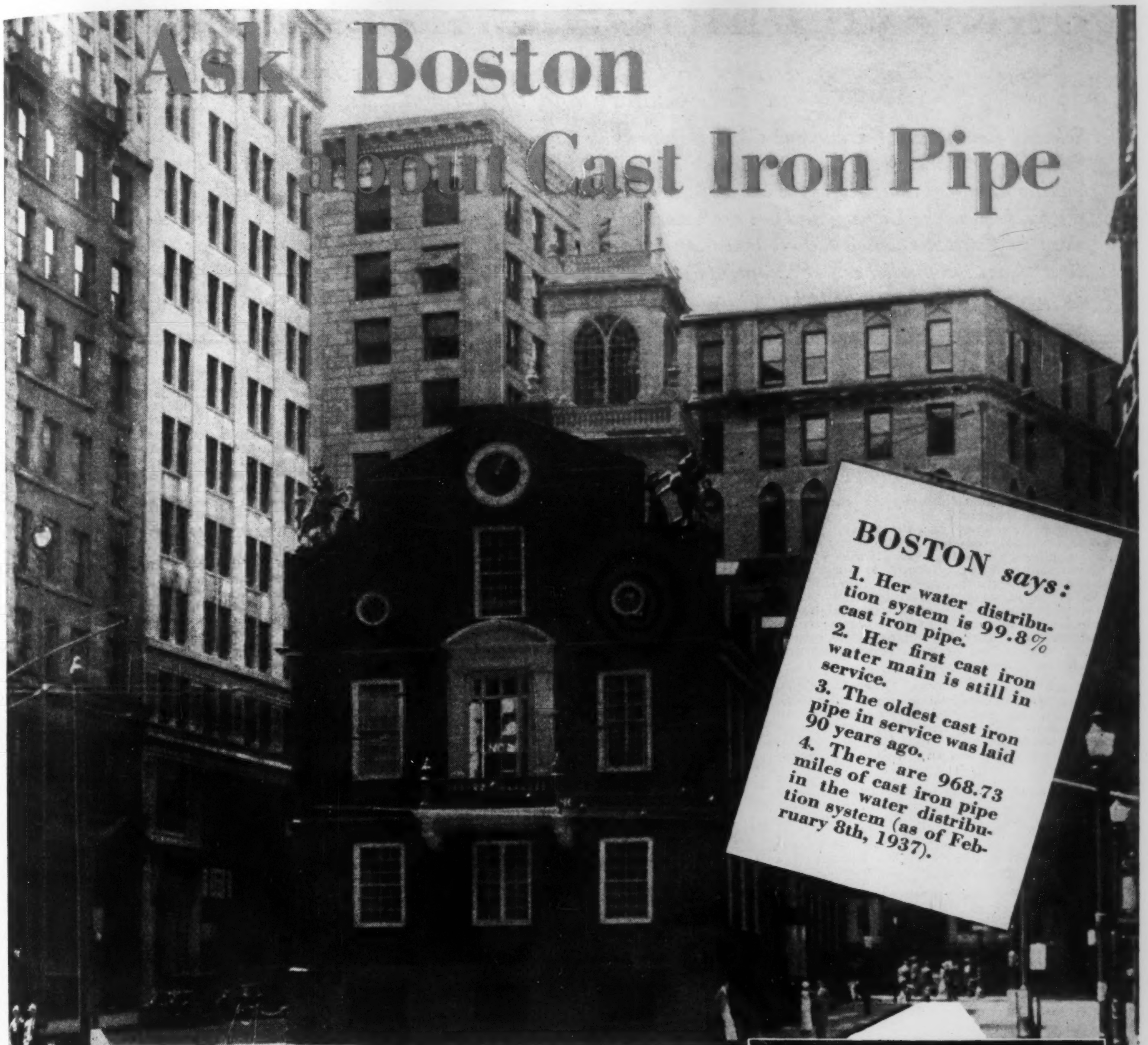
This, the second of the series of Studies in Comparative Seismology, makes special reference to the dynamic conditions and geologic structures giving rise to earthquakes, upon which the Carnegie Institution of Washington is engaged. In it Professor Willis presents a detailed account of his observations in East Africa, a review of existing theories regarding the origin of the rift valleys, and his own hypotheses regarding them. The report is an important contribution to geological literature. There is a bibliography.

Elementary Architectural Drawing. By W. S. Lowndes. Scranton, Pa., International Textbook Co., 1936. Illus., diagrs., charts, tables, 8 × 5 in., leather, $1.30.

A brief textbook for beginners, designed for home study.

Verkehrswissenschaftliche Tagung 1936. Veranstaltet vom Verkehrswissenschaftlichen Forschungsrat beim Reichsverkehrsministerium und vom Verein deutscher Ingenieure. Berlin, VDI-Verlag, 1936. 38 pp., illus., diagrs., charts, tables, 12 × 8 in., paper, 4 rm.

This pamphlet reports the proceedings of a symposium on traffic, held in Berlin, on March 23, 1936. The motorization of street traffic, the importance of automobile roads, and recent problems of railway, air, and sea traffic were discussed.



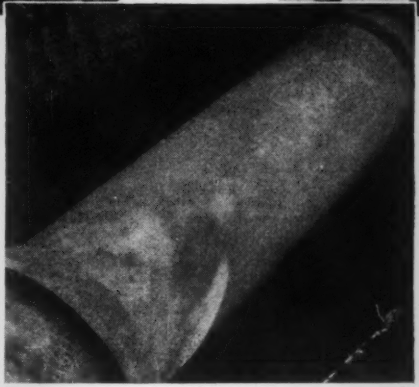
Ask Boston about Cast Iron Pipe

BOSTON says:

1. Her water distribution system is 99.8% cast iron pipe.
2. Her first cast iron water main is still in service.
3. The oldest cast iron pipe in service was laid 90 years ago.
4. There are 968.73 miles of cast iron pipe in the water distribution system (as of February 8th, 1937).

Three generations of thrifty Bostonians — taxpayers, public officials and engineers — have known the service of cast iron pipe and found it good. Result: the use of substitutes for cast iron pipe in Boston's water distribution system is confined to a fraction of one per cent of the system; all the rest is cast iron pipe. Since John Quincy Adams dug the first spadeful of earth in excavating for Boston's original cast iron water line 90 years ago, many changes in engineering practice have occurred. But engineering endorsement of the durability and economy of cast iron pipe has remained constant through the generations.

The water distribution systems of our 15 largest cities are 95.6 per cent cast iron pipe—the standard material for underground mains. Cast iron pipe's useful life is *more than a century* because it effectively resists rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust. Available in diameters from 1¼ to 84 inches. For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1013 Peoples Gas Bldg., Chicago.



A section of Boston's original cast iron water main laid in 1847 and still in service. Photo above shows the historic old State House in the modern setting of Boston of today.

CAST IRON PIPE

The Standard Material for Underground Mains

TRADEMARK REG.

CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N. Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

Highway, Approaches. 2,200,000 Bd Ft Creosoted Timber and 570,000 Lin Ft Creosoted Piles in Triborough Bridge Approach. *Wood Preserving News*, vol. 15, no. 8, Aug. 1936, pp. 91–94, and 102. Platform 4,600 ft long to support East River drive constructed of 1,120 creosoted pile and timber bents.

Highway, Stresses. Provas de carga das pontes de São Vicente e de Jacarehy, T. van Langendonck. *Instituto de Pesquisas Technologicas de S. Paulo—Boletim*, no. 16, Aug. 1936, 52 pp., supp. plates. Loading tests on São Vicente and Jacarehy bridges; former is suspension bridge that connects continent to São Vicente island; latter is three-span reinforced concrete arch bridge in São Paulo–Rio de Janeiro highway, that crosses Parahyba River; details concerning bridges; method of carrying out tests and results obtained; comparison between test results and those expected from theory.

Steel Truss, India. New Howrah Bridge, G. Wilson. *Indian Eng.*, vol. 99, no. 5, May 1936, pp. 158, 160, 162, and 164. Comparative study of two designs for proposed Petit and K-truss bridge between Calcutta and Howrah, India; about 2,100 ft total length; height of towers about 240 ft.

Steel Truss, Manitoba. New Highway Bridge Over Red River at Selkirk, Manitoba, H. W. White. *Can. Engr.*, vol. 72, no. 2, Jan. 12, 1937, pp. 5–8. Seven-span steel-truss bridge, 765 ft long, with one-beam span, five deck-truss spans, and one 90-ft pony-truss vertical lift span providing clearance of 87 ft.

Suspension, Design. Theory of Suspension Bridge, A. A. Jakkula. *Assn. Internationale des Ponts et Charpentes—Mémoires*, vol. 4, 1936, pp. 333–358. Theoretical, mathematical, and graphical analysis of problem; author undertakes to simplify existing methods of calculation. (In English, with brief abstracts in German and French).

Suspension, Honduras. Bridging Rio Choluteca with Two-Span Suspension Structure, C. B. McCullough and R. Archibald. *Eng. News-Rec.*, vol. 118, no. 3, Jan. 21, 1937, pp. 87–88. Design and construction of Pan-American Highway suspension bridge in Honduras, consisting of two 330-ft main spans and loaded backstay side spans of 110 ft.

Viaducts, Plate Girder. Die Sulzbachtalbruecke bei Denkendorf, K. Schaechterle. *Bautechnik*, vol. 14, no. 36, Aug. 18, 1936, pp. 497–512. Sulzbach plate-girder viaduct carrying German superhighway between Stuttgart and Ulm, consisting of seven spans totaling 365.4 m in length; maximum elevation above valley floor 35 m; ultimate maximum total width 21.5 m; supporting bents hinged at both ends.

Wooden. Typical and Notable Timber Bridges. *Roads & Road Construction*, vol. 14, nos. 165, 167, and 168, Sept. 1, 1936, pp. 265–266; Nov. 2, pp. 342–343; and Dec. 1, pp. 379–380. Truss and arch composite spans; composite types in timber construction; three main arch types; Great Western Railway viaducts; composite structures. Bibliography.

Wooden, Concrete Deck. Delaware Builds Composite Laminated Timber Concrete Bridge Across Mill Creek, Near Dover. *Wood Preserving News*, vol. 15, no. 1, Jan. 1937, pp. 8–11, and 14–15. Design of 100-ft bridge of 5 spans built of timber with concrete wearing surface.

Wooden, Oregon. Three-Hinge Timber Arch Bridge Built by CCC in Oregon, W. D. Smith. *Eng. News-Rec.*, vol. 117, no. 27, Dec. 31, 1936, pp. 920–922. Description of wooden highway bridge of 135-ft arch span designed to make fabrication and erection as simple as possible, built with inexperienced labor on North Umpqua River, Oregon.

BUILDINGS

Apartment Houses, Foundations. Creosoted Piles Support Buildings in Government Housing Project. *Wood Preserving News*, vol. 15, no. 10, Oct. 1936, pp. 116–119. Use of pressure creosoted piles under foundations of apartment houses in Camden, N.J.

Exhibitions, San Francisco. Constructing Island Site for Golden Gate Exposition. *Western Construction News*, vol. 11, no. 8, Aug. 1936, pp. 243–246. Dredging of 23,000,000 cu yd of hydraulic fill to build 385-acre area for 1939 international fair and permanent airport; U. S. Corps of Engineers direct operations on $4,000,000 WPA project; dredging equipment; specifications.

Welding, Structural Steel. Westinghouse Completes All-Welded Building, E. H. Sykes. *Welding Engr.*, vol. 22, no. 1, Jan. 1937, pp. 36–37. Welding features of Westinghouse Electric and Manufacturing Company's building in Mansfield, Ohio; building has more than 300,000 sq ft of floor space; simplicity of design, coupled with many new building features, including air conditioning, marks construction features of building, which was made necessary by present inadequate plant facilities.

CITY AND REGIONAL PLANNING

Airports, United States. Airport Support for Municipalities. *Eng. News-Rec.*, vol. 118, no. 6, Feb. 11, 1937, p. 216. Brief abstract of report by American Municipal Association leading to conclusion that definite and complete federal action is needed for national system of civil airways and airports, in order that cities may know where they stand in the future.

Germany. Zum Kieler Staedtebauwettbewerb, H. de Fries. *Deutsche Bauzeitung*, vol. 70, no. 47, Nov. 18, 1936, pp. 937–958. Critical review of projects submitted for replanning old sections of city of Kiel, Germany.

Methods. Technique for Planning Complete Communities—I, A. Mayer. *Arch. Forum*, vol. 66, no. 1, Jan. 1937, pp. 19–36. Method of planning U. S. Resettlement Administration Greenbelt Towns as illustrated by Greenbrook settlement near New Brunswick, N.J.

Slums. Method for Private Enterprise to Rebuild Cities, C. A. Perry. *Arch. Rec.*, vol. 81, no. 1, Jan. 1937, pp. 11–17. Project for abolition of slums in large cities by private enterprise; 5-block apartment development; attitude of government; excess condemnation; public benefits; apartment parks; public school problem; dispossessed tenement dwellers.

Tennessee Valley Authority. Tennessee River Experiment. *Eng. News-Rec.*, vol. 117, nos. 23, 24, 25, 26, and 27, Dec. 3, 1936, pp. 771–779; Dec. 10, pp. 823–827; Dec. 17, pp. 860–865; Dec. 24, pp. 897–901; and Dec. 31, pp. 929–933. December 3: Introduction. December 10: Water Conservation and Flood Control. December 17: Navigation and Power on Tennessee. December 24: River and Region. December 31: River Development on Trial.

CONCRETE

Cement, Pozzuolan. Portland-Pozzuolan Cement in Bonneville Spillway Dam, R. R. Clark. *Eng. News-Rec.*, vol. 118, no. 6; Feb. 11, 1937, pp. 219–222. Selection of type of cement, based on laboratory tests, for construction of main spillway dam across Columbia River; comparison of cements by heat of hydration, water gain, and permeability favored pozzuolan, specified as to content and manufacturing process; observations on first 275,000 cu yd placed confirm expectations; portland-pozzuolan specifications; comparison in temperature rise on three dams; concreting experience.

Deformation. Aspects nouveaux des problèmes du ciment armé, E. Freyssinet. *Assn. Internationale des Ponts et Charpentes—Mémoires*, vol. 4, 1936, pp. 265–304. New aspects of reinforced concrete problems; conclusions based on investigations by author and others; hypothesis has been formed which would explain deformations of concrete as certain mechanical and geometrical properties of very small molecular interstices of cement slurry.

CONSTRUCTION INDUSTRY

Costs. Unit Bid Summary. *Western Construction News*, vol. 11, no. 9, Sept. 1936, (adv. sec.) pp. 36, 38, 40, 42, 44, and 46. Unit costs bid on dam construction, street and road work, irrigation and reclamation, and sewer construction in Idaho, Colorado, Oregon, California, and other western states.

Public Works, United States. Status of Major Projects. *Eng. News-Rec.*, vol. 118, no. 5, Feb. 4, 1937, pp. 182–191. Status of important American jobs at end of 1936; water supply projects; sewage treatment; flood control; waterways; irrigation and power; land reclamation; bridge construction; status of PWA housing projects in the United States.

DAMS

Boulder Dam Project. Boulder Dam—Milestone in Construction Man's Career, C. J. Thomson. *Gen. Elec. Rev.*, vol. 39, no. 10, Oct. 1936, pp. 475–478. Author cites some of his experiences in construction work on large projects in South America and Russia and gives details of assembling of units at Boulder Dam.

Concrete Arch, Maintenance and Repair. Repairing Large Multiple-Arch Dam by Program of Buttress Reinforcing, J. A. Fraps. *Western Construction News*, vol. 11, no. 9, Sept. 1936, pp. 286–288. Repairing of Lake Pleasant multiple-arch dam on Agua Fria River in Arizona, which is 250 ft high and 2,000 ft long, by filling all buttresses in stream bed with concrete, adding new heavily reinforced cross wall along upstream face of buttress, and adding series of horizontal floors at various elevations.

Concrete, Construction. Pumping Concrete to Complete Dam 16 on Mississippi River. *Contractors & Engrs. Monthly*, vol. 33, no. 6, Dec. 1936, pp. 1, 27, and 40. Central mixing and pumping of 45,000 cu yd of concrete in construction of lock and dam across Mississippi River at Muscatine, Iowa; description of equipment and its operation.

Concrete Gravity, Canal Zone. Madden Dam, Sluiceways and Outlets, P. S. O'Shaughnessy. *Military Engrs.*, vol. 28, no. 162, Nov.-Dec., 1936, pp. 438–442. Features of outlet pipes and needle valves; test data obtained on sluiceway operation.

Earth, New Mexico. Caballo Dam on Rio Grande to Store 350,000 acre-ft. *Western Construction News*, vol. 11, no. 9, Sept. 1936, pp. 294–295. Features of 86-ft high large earth-fill dam project in New Mexico, which will provide additional reservoir for Rio Grande Project and flood control for river improvement program of International Boundary Commission; work involves 1,160,000 cu yd of fill.

Earth, Nevada. Bid Call for Boca Dam on Nevada Irrigation Project. *Western Construction News*, vol. 11, no. 9, Sept. 1936, p. 285. Features of earth and rock-fill dam near Reno, Nev.; 110 ft maximum height; 1,650 ft long.

DESIGN BY PRINCIPLE OF CONTINUITY NOW SIMPLIFIED

FOR THE STRUCTURAL ENGINEER: a more efficient and accurate analysis of building frames.

FOR THE BUILDING OFFICIAL OR BUILDING OWNER: safer, stronger and more rigid construction at given cost.

Concrete building frames need no longer be designed by the imperfect formulas 1/10, 1/12 and $1/16\ wl^2$.

As every engineer knows, the present practice of designing beams in building frames by use of moment coefficients does not always give an adequate solution. It disregards important elements including concentrated loads and the ratios of live load to dead load, column stiffness to beam stiffness, and column width to span length. Column moments are also ignored.

Why has this inadequate practice continued? Because there was no other simple method.

Simple, Accurate Method Now Available

Today, however, any competent designer can apply the principle of continuity in designing building frames. Methods have been simplified. An office design practice is now available—quick, easy, convenient, and accurate. By using this practice, the engineer may cut his design cost, and at the same time produce a well-balanced structure requiring a minimum of material, placed for greatest structural efficiency.

American Concrete Institute Code Specifies Use of Principle of Continuity

This code requires that "all members (of building frames) shall be designed to resist at all sections the maximum bending moments and shears . . . as determined by the principle of continuity." Reinforced concrete building frames are inherently continuous.

Design Method Summarized in New Booklet

"Continuity in Concrete Building Frames," gives simple method of analysis and examples of application for vertical load and wind pressure. Mail coupon for free copy.

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Please send me booklet "Continuity in Concrete Building Frames."

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PROGRESS. Dam Building Reaches a Climax, R. A. Sutherland. *Eng. News-Rec.*, vol. 117, no. 24, Dec. 10, 1936, pp. 807–815. Review of progress of past decade characterized by completion of dams of unprecedented heights and ever-increasing volume; gravity, arch, buttress, and earth and rock-fill types; tabulated data on dams of all types over 100 ft high.

FLOOD CONTROL

DISCHARGE. Determining Flood Discharges from Small Watersheds, D. L. Yarnell. *Agric. Eng.*, vol. 18, no. 1, Jan. 1937, pp. 13–14. Graphic method of representing relationship between amount of rainfall and flood discharges to make possible prediction of flood magnitudes and frequencies from fragmentary or short-period data.

FORECASTING. Forecasting Flood Flows, W. R. Gregg. *Eng. News-Rec.*, vol. 118, no. 5, Feb. 4, 1937, pp. 198–199. Review of experience of U. S. Weather Bureau, showing that it is possible to forecast amount of flood flow in large rivers with reasonable accuracy, but that it is not yet possible to predict where unusual concentration of precipitation will occur, or what total precipitation will be; Bjerknes cyclone model.

MISSISSIPPI RIVER. Fighting High Waters, H. W. Richardson. *Eng. News-Rec.*, vol. 118, no. 6, Feb. 11, 1937, pp. 225–228. First-hand observations of battle to control 1937 superflood in Mississippi Valley; levee raising; kinds of river work; types of topping.

MISSISSIPPI RIVER, TESTS. Flood Control being tested on Mississippi. *Eng. News-Rec.*, vol. 118, no. 6, Feb. 11, 1937, pp. 222–225. Critical outline of Jadwin plan for flood control on the lower Mississippi River.

UNITED STATES. Superflood Devastates Lower Ohio and Now Threatens Mississippi Levee System. *Eng. News-Rec.*, vol. 118, no. 5, Feb. 4, 1937, pp. 151–156, and 205–206. Symposium includes following papers: Mississippi Flood Fighting Begins, H. W. Richardson; Paducah Evacuation Typifies Conditions on Lower Ohio, H. W. Richardson; Conditions in Flood-Beleaguered Cairo, W. W. DeBerard; Bonnet Carré Spillway Opened and "Fuseplugs" Ready, P. Wooton; How Birds Point Fuseplug Levee Was Breached with Dynamite; Twenty-Day Storm Caused Floods; Tennessee Flow Cut by Norris Dam.

UNITED STATES, CONFERENCE. Proceedings of Ohio Valley Treaty Conference. Cincinnati, Ohio, November 20, 1936. 54 pp., including 4 supp. sheets and 1 map. Proceedings of November 20, 1936, conference "to enable states of New York, Pennsylvania, West Virginia, Kentucky, Indiana, Illinois, Tennessee, and Ohio to conserve and regulate flow of, and purify waters of, rivers and streams whose drainage basins lie within two or more of said states"; suggested form for Ohio Valley Water Sanitation Compact.

UNITED STATES, PROJECTS. Flood Control Begun, G. B. Pillsbury. *Eng. News-Rec.*, vol. 118, no. 5, Feb. 4, 1937, pp. 192–195. Scope and status of federal and state flood control undertakings in United States; initial federal undertakings; national policy; projects authorized with estimated cost to United States of about $310,000,000.

FLOW OF FLUIDS

SIPHON SPILLWAYS. Grenzlelstung von Heberueberfaellen mit grossem Gefaelle, H. Lauffer. *Bautechnik*, vol. 14, no. 30, July 10, 1936, pp. 433–436. Compilation of theoretical and experimental data on maximum capacity of throats of high-head siphon spillways.

FOUNDATIONS

FAILURES. Underpinning and Shoring of Structures, S. M. Gooder. *Western Soc. Engrs.—J.*, vol. 41, no. 4, Aug. 1936, pp. 209–220. Shoring and underpinning for foundation failures; alterations for removal of columns and walls; procedure for deep underground construction; emergency shoring; building moving.

LANDSLIDES, CONTROL. Frozen Earth Used to Stop Slides at Grand Coulee. *Western Construction News*, vol. 11, no. 9, Sept. 1936, pp. 300–301. Use, for first time in dam construction, of freezing points and refrigerated brine to solidify plug to hold back slipping ground from foundation excavation.

SOILS, PHYSICS, HISTORY. Soil Mechanics Applied to Foundations and Other Engineering Problems, H. Ensz. *Western Soc. Engrs.—J.*, vol. 41, no. 2, Apr. 1936, pp. 93–102. History of soil mechanics; structures of soils; applications to pile foundations; calculations of stresses. Bibliography.

SOILS, PHYSICS, PRESSURE. Correlation of Soil Mechanics Studies with Retaining Wall Design, R. F. Leggey. *Can. Engr.*, vol. 72, no. 3, Jan. 19, 1937, pp. 5–8. Calculation of lateral earth pressures; pressure diagram for sheet-pile retaining wall; need for simple types of soil-testing apparatus, development of earth-pressure diagrams. Before First International Conference on Soil Mechanics and Foundation Engineering, Harvard Univ.

HYDRAULIC ENGINEERING

HYDRODYNAMICS, EDUCATION. Geraete fuer den Stroemungstechnischen Unterricht, S. Eicke. *VDI Zeit*, vol. 80, no. 46, Nov. 14, 1936, pp. 1369–1373. Description of equipment used for laboratory instruction in aerodynamics and hydrodynamics, including models and apparatus for visualizing flow of fluids.

HYDROLOGY AND METEOROLOGY

CYCLES. Compound Weather and Climatic Cycles—I, H. P. Gillette. *Water Works & Sewerage*, vol. 84, no. 1, Jan. 1937, pp. 25–26. Theory regarding weather cycles; results of search for compound cycles built up by subharmonic cycles in which harmonic factors are odd integrals.

RAIN AND RAINFALL, ITALY. Le Precipitazioni Atmosferiche a Padova, G. Crestani, F. Ramponi and L. Venturelli. *Magistrato Alle Acque-Ufficio Idrografico—Publ.*, no. 137, 1935, 166 pp. Analysis of practically uninterrupted record of rainfall at Padua, Italy, since 1724; minima and maxima of rainfall.

RAIN AND RAINFALL, RECORDS. Rainfall and Runoff of Kansas River Watershed Above Topeka, L. V. White. *Kansas Eng. Soc.—Year Book*, 1936, pp. 35–40, 1 supp. sheet. Rainfall and runoff records; stream gaging stations; Kansas River watershed; vegetation; Miami Conservancy District of Ohio; climate; evaporation; annual rainfall, runoff, and retention.

RUNOFF. Prediction of Runoff Aided by Grouping Rainfall Data, C. H. Eiffert. *Eng. News-Rec.*, vol. 117, no. 27, Dec. 31, 1936, pp. 917–919. Outline of author's method for combining records of areas possessing uniform rainfall characteristics to produce single record for total number of years covered, making possible long-range prediction of excessive precipitation; frequency of rainfall at 18 selected stations in Iowa; time of maximum runoff.

SEISMOLOGY. Seismic Survey Program Extended Into Montana. *Eng. News-Rec.*, vol. 118 no. 3, Jan. 21, 1937, p. 89. Description of strong motion accelerographs of improved design added to large group of recording instruments installed in California by U. S. Coast & Geodetic Survey.

UNITED STATES. Droughts and Floods, J. C. Hoyt. *Eng. News-Rec.*, vol. 118, no. 5, Feb. 4, 1937, pp. 196–197. Review of abnormal weather conditions during 1936 as reflected in unprecedented floods and repetition of severe droughts; average flow of streams was normal but ground-water levels were generally lower in West; flood flows of 1936 in northeastern United States.

IRRIGATION

INDIA. Importance of Irrigation. *Indian Eng.*, vol. 100, no. 1, July 1936, pp. 32 and 34–35. Review of first report of Central Board of Irrigation for India, covering extent of projects, seepage losses, channel linings, river control, Poona Research Station, river changes, areas of irrigation, and future projects.

LAND RECLAMATION AND DRAINAGE

SWAMPS. Draining Swamp Land with Vertical Drains. *Contractors & Engrs. Monthly*, vol. 33, no. 5, Nov. 1936, pp. 5 and 26. California experiments with gravel and rock-filled vertical and horizontal drains in reclaiming swamp at El Cerrito, north of Oakland, Calif.; boring for piles; boring rig; laterals.

MATERIALS TESTING

CONCRETE REINFORCEMENT. Highway Engineers Study Bond Strength of High-Elastic-Limit Steel. *Concrete*, vol. 45, no. 2, Feb. 1937, pp. 9–10. Scope and summary of results of tests by H. J. Gilkey and G. C. Ernst, of bond strength of rail steel bars and cold drawn-steel wire as concrete reinforcement. Before Highway Research Board.

PORTS AND MARITIME STRUCTURES

BEACHES, NEW YORK. Construction and Maintenance of Public Beach at Rockaway Beach, Borough of Queens, C. T. Steiner. *Mun. Engrs. J.*, vol. 22, 3d quarterly issue, 1936, pp. 107–119, (discussion) 119–122. Physiography of Rockaway Beach, New York; investigations and development; maintenance operations.

LONDON. London Port Improvements to Cost Sixty Million. *Eng. News-Rec.*, vol. 118, no. 2, Jan. 14, 1937, pp. 50–51. Outline of four-year program calling for widening and deepening of present docking areas, additional quays, and numerous warehouses and transit sheds; provision made for large new docking areas; characteristics of London docks.

PILES, WOODEN, PRESERVATION. Erosion of Canal Banks Prevented by Creosoted Sheet-Pile Bulkheads, R. H. Mann. *Wood Preserving News*, vol. 15, no. 1, Jan. 1936, pp. 5–6 and 12. Details of creosoted timber bulkheads used for over 2,800 ft along Bayhead–Manasquan Canal, N.J.

PIERS, WOODEN. Preframed Creosoted Timber and Piles in New Chesapeake and Ohio Piers. *Wood Preserving News*, vol. 15, no. 10, Oct. 1936, pp. 123–126. Method of construction of piers for Chesapeake and Ohio Railway at Newport News, Va.

RAILROAD STRUCTURES, HARBORS AND RIVERS. Report of Committee XXV—Waterways and Harbors. *Am. Ry. Eng. Assn.—Bul.*, vol. 38, no. 389, Sept. 1936, pp. 141–159. Warehouse piers, coal piers, car-float piers; size and depth of slips required for various traffic conditions; what is navigable water in fact.

SAVANNAH, GA. Port of Savannah. *Mar. News*, vol. 23, no. 6, Nov. 1936, pp. 67–69. Data pertaining to port developments and facilities.

SEAWALLS. Nachtraegliche Standsicherung von Ufermauern, A. Schroeter. *Zentralblatt der Bauverwaltung*, vol. 56, no. 29, July 15, 1936, pp. 664–665. Review of methods used by German engineers for increasing stability of existing seawalls, illustrated with recent examples.

ROADS AND STREETS

CONCRETE. Concrete Mix and Finishing for Modern Highway. *Western Construction News*, vol. 11, no. 9, Sept. 1936, pp. 291–293. Review of mixing, placing, and finishing procedure, using 5-sack mix concrete, on 11.2 mile paving contract for California Division of Highways.

CONSTRUCTION. Some Relations of Highway Construction Outfit to Unit Operating Costs, A. P. Anderson. *Roads & Streets*, vol. 79, nos. 11 and 12, Nov. 1936, pp. 21–26, and Dec., pp. 25–28. Selection of construction equipment; factors affecting unit costs; depreciation; rate of production.

CONSTRUCTION. Washington Rebuilding Important Highway Route over Stevens Pass, G. E. Johnson. *Western Construction News*, vol. 11, no. 9, Sept. 1936, pp. 282–285. Construction of 4.4 miles of concrete road in relocation of existing road to provide principal outlet from Wenatchee Valley to Puget Sound; river channel deepened through Granite gorge.

CONVICT LABOR. Rebuilding Men by Building Roads. *Contractors & Engrs. Monthly*, vol. 33, no. 5, Nov. 1936, pp. 2, 17, and 26. Operation of California's progressive system of road construction by convict labor as practiced by San Quentin prison.

DESIGN. Design for Maintenance. *Eng. News-Rec.*, vol. 118, no. 1, Jan. 7, 1937, pp. 2–5. Symposium including two papers: Highway Upkeep Recognized in Current Design, H. E. Surman; Coordination of Design and Upkeep Is Lacking, B. H. Petty.

DRAINAGE. Pumps Remove Storm Water, C. C. Rance. *Elec. World*, vol. 107, no. 5, Jan. 30, 1937, pp. 45 and 88. State Highway Commissioner of Michigan State Highway Department inaugurated grade-separation construction program that involved approximately $7,000,000 for 25 underpasses and 14 overpasses, making total of 39 grade separations. In overpass type, there is no drainage problem, but in cases where the highway is depressed to pass under a railroad the drainage problem rates considerable study and analysis.

EXPERIMENTAL. Experimental Work on Roads. *Roads & Road Construction*, vol. 14, no. 167, Nov. 2, 1936, pp. 347–349. Abstract of report for 1935–1936 on experimental work of Highways (Technical) Committee of Great Britain, with special reference to cement-bound macadam, tar and bituminous surfacing, thin surfacing costs, surface dressing, and footpaths in rural areas.

EXPRESSWAYS, NEW YORK CITY. New York City Opens Toll Parkway. *Eng. News-Rec.*, vol. 117, no. 26, Dec. 24, 1936, p. 887. Features of Henry Hudson Parkway 4½ miles long,

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which moves Manhattan traffic over the Harlem River and through the Bronx to the Westchester parkway system.

GROUTING. Grouting Settled Backfill Under Pavement Cuts, R. A. Mayo. *Eng. News-Rec.*, vol. 118, no. 6, Feb. 11, 1937, pp. 218–219. Practice of sand-cement grout injection developed by Elizabethtown Consolidated Gas Company, Elizabeth, N. J., for reducing breakdown of pavement patches over backfilled cuts; description of equipment used.

HIGHWAY ENGINEERING RESEARCH. Research Needs Coordination. *Eng. News-Rec.*, vol. 118, no. 1, Jan. 7, 1937, pp. 17–20. Symposium includes two papers: Research an Integral Part of Highway Design, R. R. Litehiser; Broad Gaps Are Still Open in Highway Research, J. C. Lang.

HIGHWAY SYSTEMS. Tomorrow's Roads, T. H. MacDonald. *Eng. News-Rec.*, vol. 117, no. 25, Dec. 17, 1936, pp. 868–870. Abstract of address before 1936 convention of American Association of State Highway Officials on Europe's active modernization of its highways and pressure of our own growing road use; coming road development and reorientation of national highway program; belt highways and radials; superhighways in Germany; building roads ahead of traffic; program for United States.

INTERSECTIONS. Rural Highway Intersections, R. E. Hefron. *Am. Highways*, vol. 15, no. 2, Apr. 1936, pp. 14–16. Summary of prevailing types of rural traffic in Michigan and relationship to intersections; methods of marking intersections.

MACHINERY. New Portable Bituminous Plant, J. G. Moloney. *Can. Engr.*, vol. 72, no. 4, Jan. 26, 1937, pp. 16–17. Portable continuous bituminous mixing plant built by Dominion Road Machinery Company, Ltd., Goderich, Ontario, with capacity of 60 tons per hour of hot, cold, or stabilized mix.

MACHINERY, UNITED STATES. Road Show Highlights. *Eng. News-Rec.*, vol. 118, no. 3, Jan. 21, 1937, pp. 97–100. New developments and trends in construction equipment as revealed by interviews with exhibitors at New Orleans show.

MAINTENANCE AND REPAIR. Dirt Street Maintenance, G. M. Shepard. *Am. City*, vol. 52, no. 1, Jan. 1937, pp. 39–42. Experience of St. Paul, Minn., in methods and costs with oiling, plant mix, and road mix.

MATERIALS, BITUMINOUS. Die bituminoesen Stoffe fuer den Bau von Schwarzstrassen, H. Suida. *Petroleum*, vol. 32, no. 16, Apr. 15, 1936, pp. 5–12. Bituminous materials in road building; properties of various asphalts and tars discussed.

RAILROAD CROSSINGS. Railroads and Highway Crossings, E. C. Lawton. *Am. Highways*, vol. 15, no. 1, Jan. 1936, pp. 29–33. Reasons for separating grade crossings; review of accomplishments in New York State.

RAILROAD CROSSINGS, ELIMINATION. Crossing Elimination, J. G. Brennan. *Eng. News-Rec.*, vol. 118, no. 5, Feb. 4, 1937, pp. 200–204. United States highway-railway grade-crossing elimination program; progress and needs; cooperation between U. S. Bureau of Public Roads, highway departments, and railroads, resulting in efficient plan of operation; current status of United States works program grade-crossing projects; apportionment of funds; obstacles to progress; direction of work; prospects; railway expenditures for elimination and protection of railway grade crossings.

RAILROAD CROSSINGS, GATES. North Western Installs Automatic Gates. *Ry. Signaling*, vol. 29, no. 9, Sept. 1936, pp. 459–463. At Greenwood Avenue crossing in Waukegan, Ill., the Chicago and North Western has installed automatically controlled, electro-hydraulic gates, in order to reduce hazard and provide full 24-hour protection in place of the 16-hour watchman service formerly in effect at this crossing.

RAILROAD CROSSINGS, SIGNALS, INDIANA. $541,000 Highway Crossing Signal Program in Indiana. *Ry. Signaling*, vol. 29, no. 12, Dec. 1936, pp. 630–635. Project includes completely new automatically-controlled flashing-light, signal installations at 204 crossings, rotating-disk signals at one crossing, gates in addition to signals at one crossing, and modernization of existing highway crossing signals at seven other locations.

RAILROAD CROSSINGS, SIGNALS, NEW YORK. Barrier Crossing Protection Installed on Long Island. *Ry. Signaling*, vol. 29, no. 8, Aug. 1936, pp. 417–420. Auto-stop automatically controlled barrier type of highway-railroad crossing protection installed on Long Island Railroad on Hicksville road near Massapequa, N.Y.

ST. LOUIS, MO. Stage Construction Employed for St. Louis Streets, L. A. Pettus. *Eng. News-Rec.*, vol. 118, no. 6, Feb. 11, 1937, pp. 228–230. Account of street engineering practice in St. Louis, Mo.; general design elements and pavement types; present attitude is to construct bases for riding surface; permanent wearing surface will be placed when base needs repairs; open curb inlets; trapped inlets used where foul and storm-water flow are combined.

SNOW REMOVAL. Keeping Snow Off Road at Little Cost, B. H. Frasch. *Eng. News-Rec.*, vol. 118, no. 3, Jan. 21, 1937, pp. 90–92. Experience of Ohio Highway Department with use of ingenious job-devised equipment; small plows; ice-control service; bins for treated ice-control abrasives; mechanical spreaders for trucks hauling abrasives.

SOUTH AFRICA. Roads in South Africa, T. P. Fox. *Roads & Road Construction*, vol. 14, no. 168, Dec. 1, 1936, pp. 370–372. Progress of road construction under authority of Cape Division controlling area of about 600 sq miles.

STRESSES. What Is Known of Stresses, H. M. Westergaard. *Eng. News-Rec.*, vol. 118, no. 1, Jan. 7, 1937, pp. 26–29. Mathematical discussion of old findings and new developments in interpreting results of tests and behavior of pavement in service; corner breaks in pavements and reaction offered by subgrade; coefficient of subgrade stiffness.

SUBSOILS. Road Foundation Practice. *Eng. News-Rec.*, vol. 118, no. 1, Jan. 7, 1937, pp. 6–11. Symposium including two papers: Soil Surveys and Stabilization Control Practice, T. E. Stanton, Jr.; Measures of Soil Behavior Are Still Imperfect, A. Casagrande.

SURFACE TREATMENT. Road Surfacings. *Surveyor*, vol. 90, no. 2344, Dec. 25, 1936, pp. 743–744. Review of results of measurements of non-skid properties made by Road Research Laboratory of British Department of Scientific and Industrial Research on various types of surfaces under many varying climatic conditions and speeds.

SURVEYING. Mechanical Aids to Rapid Surveys for Trunk Roads, H. J. Collins and C. A. Hart. *Surveyor*, vol. 90, no. 2339, Nov. 20, 1936, pp. 599–601. Type of equipment and methods required for rapid surveying of 4,500 miles of national roads in Great Britain.

SEWERAGE AND SEWAGE DISPOSAL

CHEMICAL PROCESS. Trends in Chemical Treatment of Sewage, C. C. Agar. *Mun. Sanitation*, vol. 8, no. 1, Jan. 1937, pp. 33–36. Explanation of original chemical processes; difference between chemical and biological treatment; development of chemicals and their application; advantages of chemical processes.

EUROPE. Sewage Treatment of Today in Western Europe, W. Rudolfs. *Mun. Sanitation*, vol. 8, no. 1, Jan. 1937, pp. 65–66, 69, and 74. Appraisal of practices and trends in England, France, Belgium, Switzerland, Holland, and Germany.

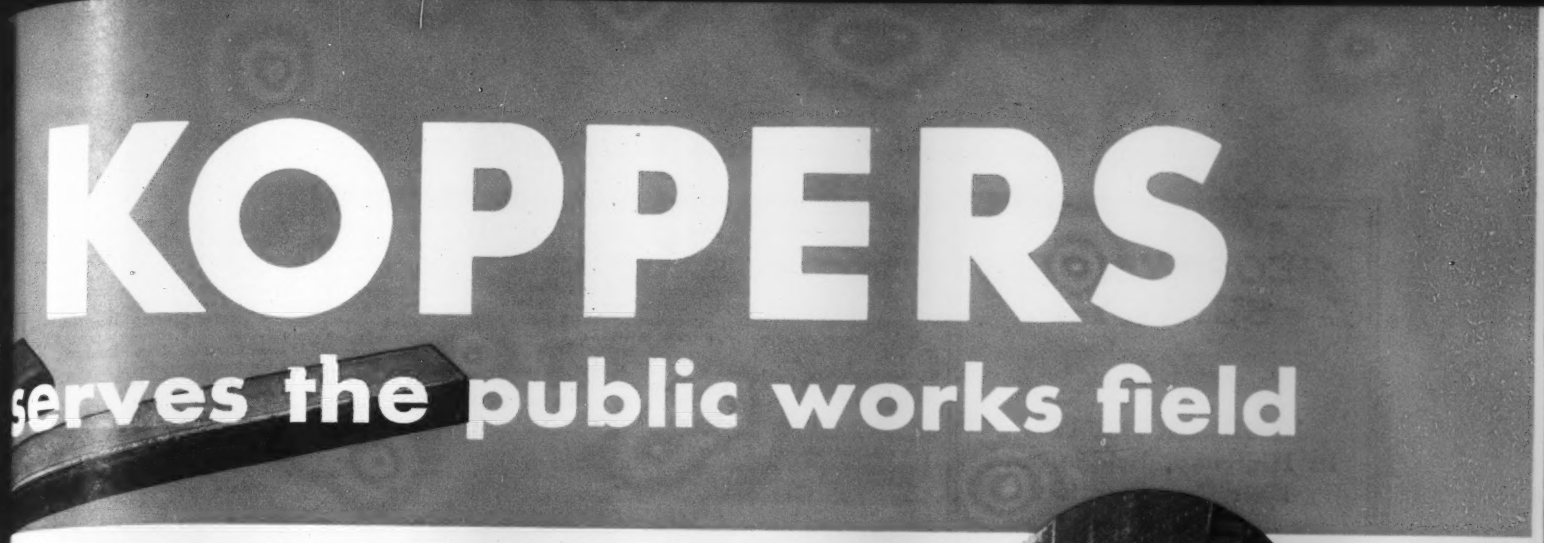
INDUSTRIAL WASTE. Industrial Waste Treatment Progress Reviewed by Wisconsin Department, L. F. Warrick. *Mun. Sanitation*, vol. 8, no. 1, Jan. 1937, p. 28. Present status of treatment in Wisconsin of such wastes as those of malt houses, canneries, milk plants, pulp and paper mills.

PLANTS. Recent Achievements in Sewage Treatment, J. F. Skinner. *Mun. Sanitation*, vol. 8, no. 1, Jan. 1937, pp. 21–24. Review of outstanding sewage-works construction activities of past few years with brief descriptions of plants.

PLANTS, GREAT BRITAIN. Centralized Sewage Disposal for Greater London Area. *Eng. News-Rec.*, vol. 117, no. 26, Dec. 24, 1936, pp. 891–892. Features of Mogden purification works, providing sewage treatment for 16 communities formerly served by 28 disposal plants; design features 2-stage systems of sedimentation and sludge digestion; total cost of undertaking was about $27,100,000.

PLANTS, MAINTENANCE AND REPAIR. Some Minor Engineering Problems Which Face Sewage Works Superintendent, J. W. Procter. *Surveyor*, vol. 90, no. 2344, Dec. 25, 1936, pp. 751–753. Problems dealing with installation, inspection, and maintenance of pumps, electric motors, drives, and valves. Before Inst. Sewage Purification.

REFUSE COLLECTION. Fifth Public Health Exhibition. *Engineering*, vol. 142, nos. 3698 and 3699, Nov. 27, 1936, pp. 581–584, and Dec. 4, pp. 622–625. Illustrated account of some of exhibits at Royal Agricultural Hall, Islington, with special reference to refuse collectors, gully emptiers, street cleaning trucks, etc.



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Elastic Limit	50,000	66,200
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Red. of Area	10	12.5
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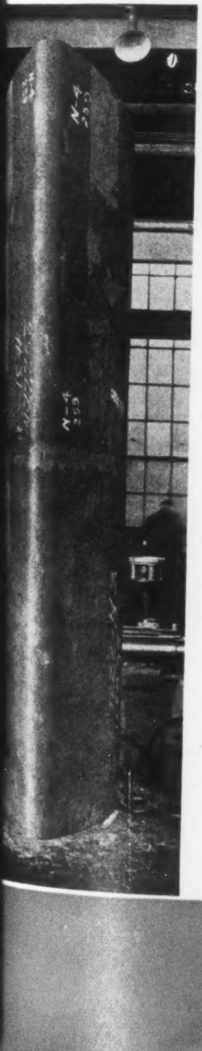

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REFUSE DISPOSAL, GRINDING. St. Louis Grinds Its Garbage. *Eng. News-Rec.*, vol. 118, no. 2, Jan. 14, 1937, pp. 58–61. Hog-feeding disposal method abandoned in favor of municipal operated central grinding stations where garbage is macerated in hammer-mills and flushed into sewers which empty into Mississippi River; grinding scheme tested; operation of plant; pollutional effect on river; collection methods.

RESEARCH. Dispersed and Colloidal Matter in Sewage, E. V. Mills. *Surveyor*, vol. 90, no. 2339, Nov. 20, 1936, pp. 619–622. Dialysis of sewage; estimation of dispersed matter in sewage; stability of sewage dispersates; review of investigations at University College, London; coagulation by bubbles of gas and by agitation; sedimentation; use of percolating filter; sludge digestion. Before Inst. Sewage Purification.

RURAL. Sewage Disposal in Rural Areas, W. W. Baum. *Surveyor*, vol. 90, no. 2329, Sept. 11, 1936, pp. 291–292 Advantages of different methods for different purposes; use of septic tanks; operation of filters; problems arising from milk wastes. Before Sanitary Inspectors' Assn.

SEWERS, CONCRETE. Double Barrel Box Section Interceptor Sewer, W. N. Pore. *Minn. Federation Arch. & Eng. Soc.—Bul.*, vol. 21, no. 12. Dec. 1936, pp. 7–8. Construction of twin-barrel concrete interceptor 22 ft wide, 11 ft 10 in. high, and 6,032 ft long for Minneapolis–St. Paul sewage disposal system; details of design; contractor's equipment; pile-driving tests; pile-driving experience; concreting.

SEWERS, CONSTRUCTION. Sewer Construction and Maintenance; E. T. Kiliam. *Mun. Sanitation*, vol. 8, no. 1, Jan. 1937, pp. 44–46. Developments in new methods of construction, new materials, and new jointing devices; maintenance problems; explosion hazards.

SEWERS, GREAT BRITAIN. Laying of Sea Outfall Sewers, G. A. Peache. *Surveyor*, vol. 90, no. 2333, Oct. 9, 1936, p. 405. Method of construction applicable to sea outfall sewers to avoid delays caused by bad weather and to simplify process of laying pipe on sea bottom. Before Instn. Sanitary Engrs.

SEWERS, INDIA. Common Sense in Engineering Sewerage, F. C. Temple. *Indian Eng.*, vol. 100, nos. 3, 4, and 5, Sept. 1936, pp. 87–88; Oct., p. 126, and Nov., p. 161. Prejudice against underground sewers; practices in Calcutta, Bombay, and Madras.

SEWERS, WINNIPEG, MANITOBA. Construction and Progress on Greater Winnipeg Sewerage System, S. B. Snow. *Can. Engr.*, vol. 72, no. 1, Jan. 5, 1937, pp. 5–8 and 16. Profile and plan of interceptors and secondaries of gravity system adopted; dimensions; concrete construction; river crossings; outfall sewer.

STRUCTURAL ENGINEERING

BRICK CONSTRUCTION, REINFORCED. Reinforced Brickwork, L. W. Burridge. *Roy. Inst. Brit. Architects—J.*, vol. 44, 3d series, no. 6, Jan. 23, 1937, pp. 285–295. Review of possibilities and developments to date; history of reinforced brickwork; factors in structural design; advantages; possible development of reinforced brickwork; numerical examples of design methods. Bibliography.

FLOORS, SOUNDPROOFING. Effect of Air Coupling in Acoustic Insulation by Means of Elastic Supports, A. H. Davis and A. E. Knowler. *London, Edinburgh, & Dublin Philosophical Mag. & J. Science*, vol. 23, no. 152, Jan. 1937, pp. 154–157. Theoretical study showing that, in isolating floors or foundations from vibration by covering structural floor with finishing floor—if interspace between concrete finish and structural floor is enclosed at edges and is only moderately thick—forces transmitted to structural floor by air film exceed those transmitted via pads.

SURVEYING

AERIAL PHOTOGRAPHY, MAPPING. Photogrammetric Surveys Give Dam and Quarry Yardage, P. Baumann. *Eng. News-Rec.*, vol. 117, no. 27, Dec. 31, 1936, pp. 915–917. Five surveys made in San Gabriel Canyon for Los Angeles County Flood Control District; maps made with airplane equipment agree closely with ground surveys; costs relatively low.

TUNNELS

RAILROAD, FLOORS. Care and Precision Feature Rebuilding of Tunnel Floor. *Ry. Age*, vol. 102, no. 2, Jan. 9, 1937, pp. 116–118. Vertical clearance increased in Big Bend Tunnel on Chesapeake and Ohio Railroad in Virginia and West Virginia by construction of concrete-slab floor at lower level with tie blocks embedded in non-shrinking grout.

WATER RESOURCES

NEW ENGLAND. Connecticut River Valley Water Resources Bibliography. Boston, Mass., New England Regional Planning Commission. Publ. no. 40, Aug. 1936, 134 pp. Annotated bibliography on geology, precipitation, surface waters, evaporation, ground water, snow surveys, pollution, water supply, water power, flood control, navigation, population, and sewage disposal in Connecticut, Massachusetts, New England, New Hampshire, and Vermont.

UNDERGROUND, VIRGINIA. Ground - Water Resources of Shenandoah Valley, Virginia, R. C. Cady, with Analyses by E. W. Lohr. *Va. Geol. Survey—Bul.*, no. 45, 1936, 137 pp., 5 supp. sheets. Geology and hydrology of groundwater resources of Virginia, with special reference to Augusta, Page, Rockbridge, Rockingham, Shenandoah, and Warren counties; statistical data.

WATER TREATMENT

BORON REMOVAL. Solving Boron Problems in Los Angeles Water Supply, R. F. Goudey. *Western Construction News*, vol. 11, no. 9, Sept. 1936, pp. 295–297. Method of reducing boron content of Los Angeles irrigation water from maximum of 1.4 ppm to 0.5 ppm; sources of boron.

RAILROADS, WATER SUPPLY. Report of Committee XIII—Water Service, Fire Protection, and Sanitation. *Am. Ry. Eng. Assn.—Bull.*, vol. 38, no. 389, Sept. 1936, pp. 93–113. Relation of railway fire protection to municipal and privately owned water works; use of phosphates in water treatment; cause of and remedy for pitting and corrosion of locomotive boiler tubes and sheets; analysis of chemicals used in water treatment; progress in federal or state regulations relative to railway sanitation; determination of and means for reduction of water waste.

WATER WORKS ENGINEERING

CICERO, ILL. Chicago Suburb Enlarges Its Water Distribution System. D. W. Johnson. *Water Works Eng.*, vol. 90, no. 1, Jan. 6, 1937, pp. 53–54. Complete rehabilitation of water system necessitated by rapid increase in population; method of constructing pipe lines.

NEW YORK. Delaware Aqueduct Gets Underway. *Eng. News-Rec.*, vol. 118, no. 2, Jan. 14, 1937, pp. 41–44. Outline of $273,000,000 water-supply extension project, including 85-mile pressure tunnel and three reservoirs in Catskill Mountains at headwaters of Delaware River and tributary of Hudson River; details of 13 Delaware aqueduct shaft contracts.

RECENT WORK. Progress in Water Supply and Treatment During 1936, L. V. Carpenter. *Water Works & Sewerage*, vol. 84, no. 1, Jan. 1937, pp. 1–10. Effects of floods and drought; extent of new construction; new types of distribution piping; improvements in operation and maintenance; pollution control; relation of air conditioning to water supply; automatic control; trends in filtration design; progress in treatment methods.

RESERVOIRS, SILT. Silt in Water Works Reservoirs. *Water Works Eng.*, vol. 90, no. 1, Jan. 6, 1937, pp. 45–46. Practical discussion by water-works superintendents of effective methods used for checking influx of silt into reservoirs.

TANKS, CONCRETE. Water Tank Notable Landmark, J. S. Raffety. *Am. City*, vol. 52, no. 1, Jan. 1937, pp. 59–61. Elevated 500,000-gal concrete tank 62 ft in diameter and 27 ft high supported on circular concrete wall 56 ft in diameter and 50 ft high, surmounted by steeply pitched conical roof.

TANKS, WELDED STEEL. Largest All-Welded Steel Reservoirs in West for Water Supply System, J. W. Clay. *Western Construction News*, vol. 11, no. 9, Sept. 1936, pp. 289–290. Two 2,300,000-gal storage units 21 ft deep added by Alhambra (Calif.) Water Department; available space and water-surface elevation influenced design.

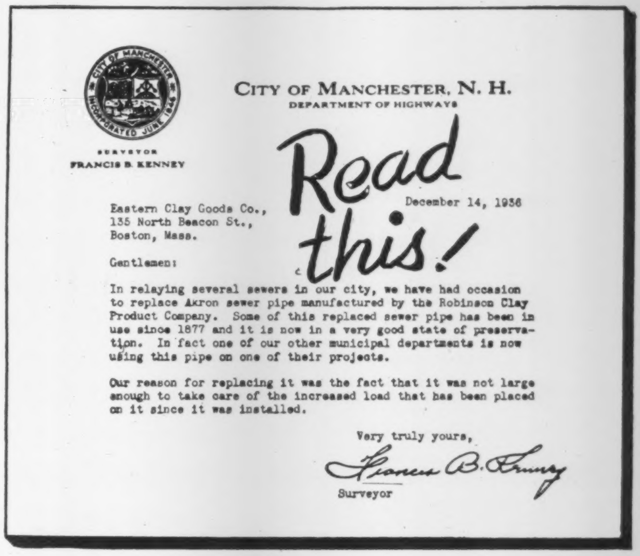
WAUKESHA, WIS. Curative Spring Waters Help to Develop City and Its Water Works, A. P. Kuranz. *Water Works Eng.*, vol. 90, no. 1, Jan. 6, 1937, pp. 34 and 37. Development of water works at Waukesha, Wis.; medicinal properties of water; use of deep wells as source of supply. Before Am. Water Works Assn.

WELLS. Wells and Well Screens, J. W. Lewis. *Indian Eng.*, vol. 100, no. 6, June 1936, pp. 214–218. Methods for maintaining yield of wells in sand and gravel formations.

GOOD AS NEW—
AFTER 59 YEARS
OF SERVICE!

This unretouched photograph is indisputable evidence of the permanency of Robinson Vitrified Clay Sewer Pipe.

This pipe has been in continuous service in a sanitary sewer since 1877 . . . subjected for fifty-nine years to those severe erosive conditions that cause the rapid deterioration and early failure of ordinary sewer pipe.



City of Manchester, N. H.
Department of Highways

Surveyor
Francis B. Kenney

Read this!

December 14, 1936

Eastern Clay Goods Co.,
135 North Beacon St.,
Boston, Mass.

Gentlemen:

In relaying several sewers in our city, we have had occasion to replace Akron sewer pipe manufactured by the Robinson Clay Product Company. Some of this replaced sewer pipe has been in use since 1877 and it is now in a very good state of preservation. In fact one of our other municipal departments is now using this pipe on one of their projects.

Our reason for replacing it was the fact that it was not large enough to take care of the increased load that has been placed on it since it was installed.

Very truly yours,

Francis B. Kenney
Surveyor

FOR years of low-cost dependable, trouble-free service . . . specify Robinson Vitrified Clay Sewer Pipe. Our engineering service is available to help you solve your problems. Literature on Robinson Products will be furnished on request.

ROBINSON PRODUCTS

- Vitrified Clay Sewer Pipe
- Single-Ring or Two-Ring Segment Blocks
- Filter Underdrains
- Robinson Dry Jute
- Vit-Liner Plates
- Septic Tanks
- Channel Pipe
- Wall Coping
- Meter Boxes
- Drain Tile
- Fire Brick
- High Temperature Cements
- G-K Asphaltic Compound for Jointing
- Acidware Pipe
- Flexlock Joints

ROBINSON

THE ROBINSON CLAY PRODUCT COMPANY, AKRON, OHIO

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THE ROBINSON CLAY PRODUCT COMPANY OF CANADA, LTD.
Toronto, Ontario, Canada, Foot of Shaftesbury Avenue

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

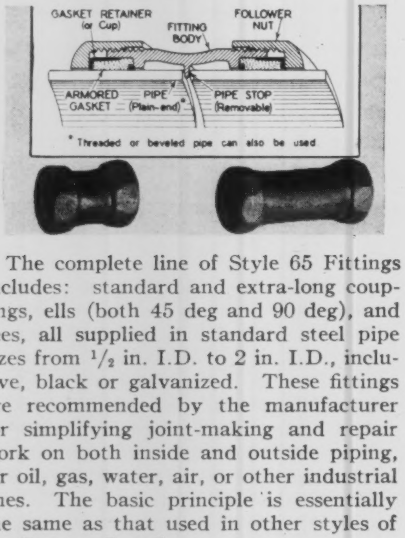
Diesel Power Units

FAIRBANKS, MORSE & Co. describes the construction and applications of its Model 36 Diesel Power Units in a new Bulletin 3600-Al. The Model 36 Diesel offered in two cylinder sizes and in various combinations, with rating as low as ten horsepower, is the smallest in the complete line of Fairbanks, Morse Diesels. It is available as a completely enclosed power unit, mounted on skids and with radiator, hood, and fuel tank for exposed installations; mounted on a cast-iron base with or without clutch and reduction gears for stationary use; and as a basic power unit for installation in portable or semi-mobile industrial and construction equipment.

The F-M MODEL 36 is a medium high speed, four-cycle Diesel. A study of the many sectional views and illustrations of parts contained in the bulletin shows the many refinements embodied in this engine. It is an engine of extreme simplicity and neat appearance, compact and completely self-contained, economical and absolutely dependable in operation.

Threadless Pipe Fittings

THREADING, grooving, or flaring pipe, or screwing up joints in cramped quarters, is no longer necessary, according to the latest announcement from S. R. Dresser Manufacturing Co., 364 Fisher Ave., Bradford, Pa. With the standard line of Dresser Style 65 Fittings just announced, only a wrench is needed to complete a joint in a few moments. After the plain-end pipes are inserted into the fitting (which comes completely assembled), two threaded octagonal follower nuts are tightened to compress the resilient "armored" gaskets tightly around the pipes, forming a positive seal.



* Threaded or beveled pipe can also be used

The complete line of Style 65 Fittings includes: standard and extra-long couplings, ells (both 45 deg and 90 deg), and tees, all supplied in standard steel pipe sizes from $\frac{1}{2}$ in. I.D. to 2 in. I.D., inclusive, black or galvanized. These fittings are recommended by the manufacturer for simplifying joint-making and repair work on both inside and outside piping, for oil, gas, water, air, or other industrial lines. The basic principle is essentially the same as that used in other styles of the Dresser Coupling.

Riveting Aluminum

THE RIVETING of aluminum and its alloys is the subject of an attractive 36 page, $5\frac{1}{4}$ by $8\frac{1}{4}$ in. booklet which was recently published by the Aluminum Company of America, Pittsburgh, Pa. Sections of this booklet are devoted to: The Strength of Riveted Joints; Proportions of Riveted Joints; Driving Methods for Riveted Joints; Selection of Rivet Alloy; and Aircraft Riveting. Illustrations, tables, and dimension drawings add to the value of the booklet.

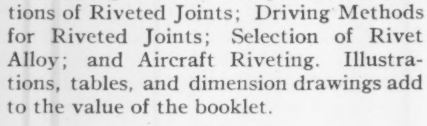
Fluted Steel Pile Shells

A NEW 16 page illustrated catalog on Fluted Steel Pile Shells for cast-in-place concrete piles has been issued by The Union Metal Manufacturing Co., Canton, Ohio.

Description of product and method of installation, specifications for various length pile shells, and many interesting job photographs are contained in this catalog. Engineers and contractors may obtain copies by writing to the manufacturer.

New Air Meters and Gages

A NEW range of Air Meters, Draft Gauges, and Air Filter Gauges, as well as a new Pitot Static Head for use with the portable types are announced by Julien P. Friez & Sons, Inc., Baltimore, Md.



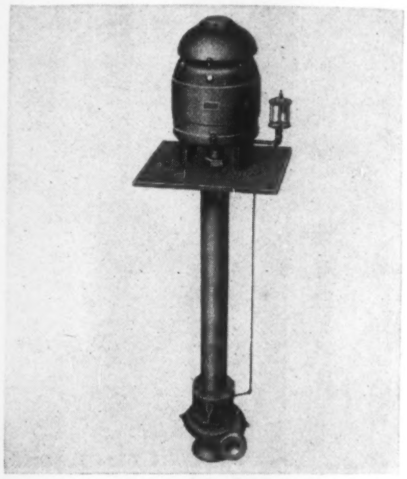
These new instruments are constructed of a clear Bakelite material and are rugged, sensitive, and reliable. They are provided with accurate, quick, and easy means for leveling before taking readings. The portable instrument with its rubber tubing and other fittings is conveniently contained in a carrying case.

Various types and ranges are available covering velocities as low as 400 ft per min and as high as 8,000 ft per min, or vacuums or pressures as low as .005 in. of water up to 4 in. of water. A unique feature of these new instruments is the chromium plates and highly polished graduated scale which reflects an image of the liquid column through the transparent Bakelite, and completely eliminates errors from parallax.

A new Friez Pitot Static Head may be used either with the new Friez instruments described above or with other instruments designed for similar purposes. Bulletin F, will be forwarded by the manufacturer.

New Application for "Freflo" Centrifugal Pumps

THE NEW application of their "Freflo" centrifugal pumps to underpass drainage is announced by the Worthington Pump and Machinery Corporation, Harrison, New Jersey. The manufacturer claims that the "Freflo" supplies the most economical method, with the exception of gravity feed, of automatically handling waste water, pumping directly from the catch basin. A simple catch basin or sump and an inexpensive housing are the only additional provisions required.



These centrifugals are made in capacities of 85 to 7,500 gal per min, are extremely simple to operate, and can be equipped for automatic starting and stopping.

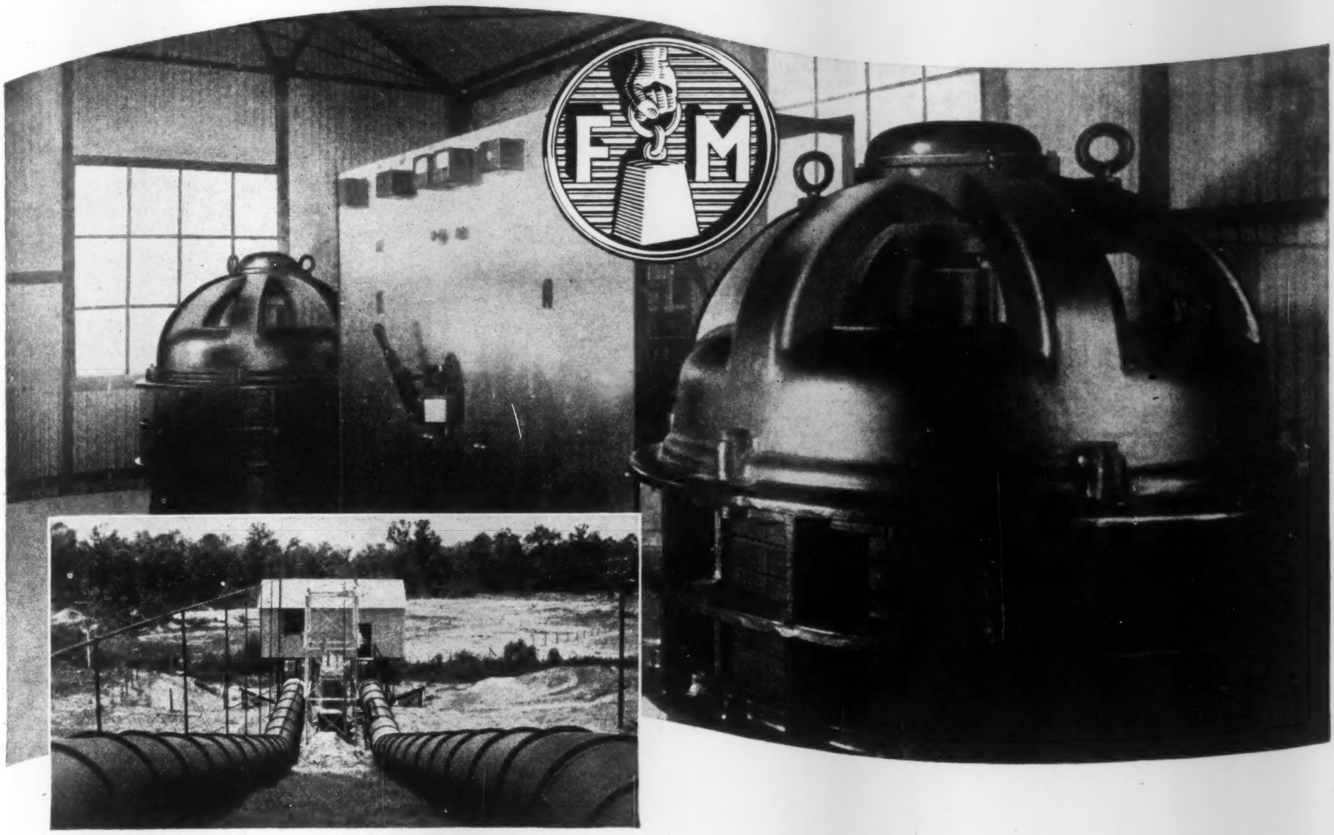
Among the advantages claimed for the "Freflo" pumps are the flared suction inlet, the free passages through the impeller and casing, and the ball thrust bearing. Bulletin W-317-B5 will be sent upon request.

Heavy Duty Tires

TRUCK tires designed for heavy service in the construction fields are announced by The B. F. Goodrich Company, Akron, Ohio.

The large tires, known as "earth movers," will carry a maximum of 15,740 lbs a casing, or nearly eight tons, are mounted on 13 in. rims, weigh 449 lbs, and are available in 12, 16, and 20 plys. The tubes weigh more than 53 lbs and the flaps 12 lbs, the manufacturer says. Four of the Goodrich tires mounted on one axle will carry 60,000 lbs. The tires may be purchased with two types of tread, one for trailer uses on free moving wheels, and the other incorporating a super-traction tread for use in mud, and soft ground.

WEST MONROE, LA. SAYS: "RIVER, STAY 'WAY FROM OUR DOOR!"



—and puts two big F-M propeller pumps on flood control duty

● Back in 1927, the Mississippi went on a rampage. The Ouachita was unable to disgorge itself, and West Monroe, La. was badly damaged by the backwater.

To keep the river away from its doors, a system of levees and concrete walls now protects West Monroe. When the river reaches flood stage and normal gravity drainage is impossible, two 54-inch vertical propeller pumps, driven by F-M 300-hp. motors, swing into action. These pumps are of the split case type, making adjustments and repair work easy. Each pump is equipped with a special patented trash cutter, exclusive with F-M drainage pumping equipment. With this cutter, the pumps are cleaned of accumulated trash, vegetation, etc., without shutdown—an invaluable asset during flood periods when failure would cause heavy property damage and loss.

Every town menaced by flood waters should study the many unique features of this installation. For your copy of an interesting article describing it in full, ask for Bulletin 6310-15. Address Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill. 34 branches at your service throughout the United States.

6959-PA31.25

FAIRBANKS MORSE

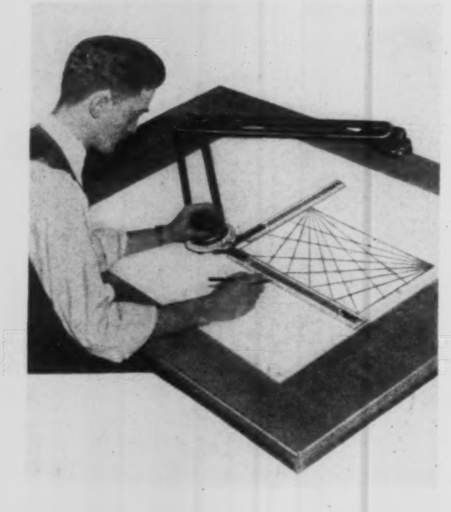
DIESEL ENGINES • ELECTRIC MACHINERY
PUMPS • FAIRBANKS SCALES • RAILROAD
EQUIPMENT • FARM EQUIPMENT • HOME
APPLIANCES • HOUSEHOLD PRODUCTS • HEATING AND AIR CONDITIONING EQUIPMENT

F M

Pumps

New Drafting Machine Has One Hand Control

A NEW drafting machine, controlled entirely by the left hand, is announced by Keuffel & Esser Co. of Hoboken, N.J. The device is designed to replace all the tools handled most frequently by a draftsman, and has many improvements and refinements that bring greater accuracy and efficiency to the drafting board. It will be known as the "K&E Paragon Drafting Machine."



This machine consists of a jointed arm of aluminum alloy, having a protractor head fitted with two scales at 90 deg. Parallel motion is maintained by tempered steel bands under constant tension, concealed within the arm sections. All moving parts turn on fine quality precision ball bearings for ease and uniformity of operation.

The protractor head allows the scales to be set and locked at any angle, to move freely in angular displacement, or to stop automatically at every 15 deg. Variations of the scale angle are made by means of a locking and stop mechanism operated by a single lever under the left thumb of the operator, so that the entire device can be operated and controlled by the left hand only.

Interchangeable scales may be quickly attached or removed to permit the use of any required scale combination. In addition to the conventional white-edged scales, a series of special scales, made of aluminum alloy with hardened black surface and white graduations and numbers, are available for use with the Paragon machine. The aluminum scales are said to be impervious to atmospheric changes, and extremely serviceable because of their resistance to wear and rough handling.

The K&E Drafting Machine is offered in two models; a standard type, with a spring counterbalance to prevent accidental motion, for use on drawing boards at any angle up to fifteen deg; and a vertical type, with a weighted counterbalance, that can be used in any position of the board from horizontal to vertical. Inspection of this machine may be made at K & E stores in most cities.

Protected Screw Takeup

A NEW protected screw takeup for conveyors and elevators is announced by the Jeffrey Manufacturing Co., Columbus, Ohio. The adjusting screw is protected from dust and dirt by an inverted-U shaped shield which extends from end to end of the takeup frame. The sliding base casting, which carries a bronze adjustment nut, is cored out in such a way that it slides freely over the shield. The adjusting screw does not travel but remains inside the frame and is protected from damage at all times. After adjustment, the bearing is rigidly clamped to the rugged steel frame.

Folders Announced

ARC WELDER—The Lincoln "Shield Arc SAE" welder, engine driven model, Type S-6018, 400 amperes is illustrated and described in a 4 page, $8^1/_2$ by 11 in.-folder. Lincoln Electric Co., Cleveland, Ohio.

HEAVY-DUTY WATER METERS—Three and four in., heavy duty disk-type, water meters are described in a new bulletin, M-975–B34. These units conform to standard specifications and are recommended for locations where the demand is too high for the usual type of disk meter. They are available with registers indicating gal, cu ft, or metric measure and are arranged for either circular or straight reading. 8 pages, $8^1/_2$ by 11 in., illustrated. Worthington Pump and Machinery Corp., Harrison, New Jersey.

INSULATORS—Vibro-Insulators for application on mechanical equipment to absorb shock and vibration are pictured, and described with dimension drawings in a 4 page, $8^1/_2$ by 11 in. folder. B. F. Goodrich Co., Akron, Ohio.

PRESSURE RECORDERS AND CONTROLLERS—An 8-page Bulletin, No. 483 describes and illustrates the new line of Low Range Pressure and Draft Recorders and Controllers. Bristol Co., Waterbury, Conn.

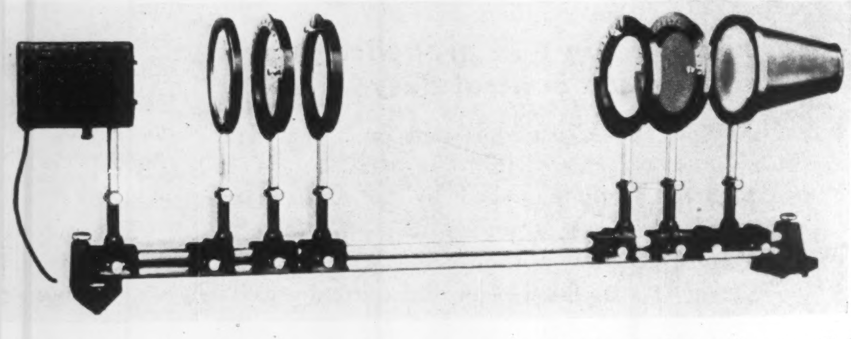
PUMPS—Bulletin No. 6165 describes duplex, self-oiling pumps for handling mud and slush, clear water, petroleum products and other liquids. These sturdy pumps are offered as basic units; with capacities from 23 to 94 gal per min and with pressures up to 475 lb per sq in. $8^1/_2$ by 11 in., 6 pages, illustrated. Fairbanks, Morse & Co., Chicago, Illinois.

SOIL TESTING—An 18 page, $8^1/_2$ by 11 in., illustrated booklet describes the instruments and apparatus offered by the American Instrument Co., 8010 Georgia Ave., Silver Springs, Maryland.

WATER TANK—A new, up-to-date elevated steel water tank bulletin (No. 101) contains 20 pages, $8^1/_2$ by 11 in. of illustration and information for efficient water storage in elevated steel tanks. Pittsburgh-Des Moines Steel Co., 3498 Neville Island, Pittsburgh, Pennsylvania.

Large Aperture Polariscope

THE POLARIZING Instrument Co., 8 West 40th Street, New York, N.Y., have just brought out a large aperture photoelastic polariscope using Polaroid as the polarizing medium.



According to the announcement, photoelastic apparatus used in the past has been complex and inconvenient. The source of polarized light was the Nicol prism which, because of its natural limitations, made it necessary to use a lens system in a long apparatus. The development of Polaroid and the use of large aperture quarter wave plates permits the construction of a compact instrument, of short length, simple in design and relatively low in cost.

The set-up is: light source; collimating lens; polarizer in rotating mount with scale for 180°; quarter wave plate in rotating mount with scale for 90°; ample loading frame space; quarter wave plate in rotating mount with scale for 90°; analyzer in rotating mount with scale for 180°; and the projection system. The striking difference between this arrangement and that using the Nicol prism is the absence of a lens between the polarizer and the analyzer. The manufacturer claims that this results in greater light efficiency and eliminates the depolarizing effect of the lenses at the edges and also the possibility of strain in the lenses, which introduces inaccuracies in the image of the stressed model.

The apparatus is made up in three standard sizes—$4^1/_4$-in., $6^1/_4$-in., and $8^1/_4$-in. aperture. Special sizes up to 12-in. aperture are available. For those who wish to construct their own apparatus, the company will sell any parts. Complete data will be sent upon inquiry.

A SURE WAY TO MAKE A HIGHWAY—*last*

AMERICAN Steel & Wire Company Wire Fabric makes highways last longer. This product ties the road slab together in every direction, binding it into a strong rigid unit. It resists settling, frost heaves, and prevents many cracks. If tiny cracks should appear Wire Fabric checks their spread, holds their edges tight and reduces spalling.

Our Wire Fabric is a factory made product. It is manufactured from cold drawn steel wire to meet the American Society for Treating Materials specification A82-34, and has been specially designed to produce best results as highway concrete reinforcement. To produce uniform stress distribution the wires are closely and evenly spaced. This product is economical because it can be put in place quickly; an operation which requires a minimum of time, effort and skill.

To suit your particular needs our Wire Fabric is furnished either in sheets or rolls and is available for quick delivery.

U·S·S WIRE FABRIC

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UNITED STATES STEEL

Men Available

These items are from information furnished by the Engineering Societies Employment Service with offices in Chicago, New York, and San Francisco. The Service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 87 of the 1937 Year Book of the Society. To expedite publication, notices should be sent direct to the Employment Service, 31 West 39th Street, New York, N.Y. Employers should address replies to the key number, care of the New York Office, unless the word Chicago or San Francisco follows the key number, when it should be sent to the office designated.

Construction

Engineer-Estimator; Assoc. M. Am. Soc. C.E.; age 35; married; 15 years experience on the design, estimating, and construction of school, office, and industrial buildings for engineers and general contractors. Will travel. Available immediately. C-16.

Construction Engineer-Estimator; Assoc. M. Am. Soc. C.E.; graduate; registered professional engineer; age 36; married; 13 years experience with building contractors on office buildings, schools, hospitals, industrial reinforced concrete buildings, estimating, purchasing, and job management; 1 year on water supply and sewage disposal work. Eastern states only. C-20.

Construction Engineer; Assoc. M. Am. Soc. C.E.; 39; graduate civil engineer; registered professional engineer, state of Pennsylvania; 13 years experience, including railroad maintenance, dredging, many types of heavy concrete and steel construction, land surveying—over 6 years on two of the largest suspension bridges. Available immediately. C-21.

Structural Engineer; M. Am. Soc. C.E.; registered engineer in Pennsylvania; thoroughly familiar with steel fabricating as well as building construction generally; desires opportunity to communicate with a promising connection. C-22.

Construction Superintendent; Assoc. M. Am. Soc. C.E.; graduate civil engineer; 35; American; protestant; married; health and physical condition good. Experienced on all kinds of piling, cofferdams, foundations, falsework, formwork, reinforced concrete, and steel erection. Has design and estimate experience. Prefers bonus contract if in charge of production. C-23.

Executive

Civil Engineer; Assoc. M. Am. Soc. C.E.; 41; single; 15 years experience in engineering department of first-class railroad. Railroad and bridge construction and valuation work; 11 years responsible charge. Familiar with all types of construction. Thoroughly experienced drafting contracts and specifications. Experience as office engineer and estimator; $1^{1}/_{3}$ years examining plans, specifications, and contracts for PWA. C-3.

Consulting-Constructing Engineer; M. Am. Soc. C.E.; who for 20 years has gone to the Far East, South America, and the West Indies, locating and building railroads and highways, water supplies, hydroelectric plants and reporting on same for investment or improvement, is open for an engagement. Can go at once. C-4.

Civil Engineer; Assoc. M. Am. Soc. C.E.; graduate of Iowa State College; 50; married. Long, varied experience in design, construction, inspection, and research in connection with irrigation, flood-control dams, and other hydraulic structures. Actual experience and natural inclination indicate employment in order of preference as follows: Designing, office management, construction, investigation and reports, research. C-9.

Civil Engineer; Assoc. M. Am. Soc. C.E.; graduate; executive with 20 years experience in management, operating, personnel, construction, valuation, and low-cost housing project planning large projects in South. Now in government service. Desires new connection after June 15. Married; in excellent health. Best-fitted for administrative, organizing, or operating tasks. Will consider what you have to offer. C-15.

Junior

Concrete Technician; Jun. Am. Soc. C.E.; 27; B.S.C.E., M.S., Lehigh University; experience as concrete technician on federal housing project; over 2 years experience in highway construction; also experience in materials testing, supervision, and maintenance. Desires position as concrete technician or materials testing engineer in field, laboratory, or teaching. Location, East or South. Available. C-5.

Engineer; Jun. Am. Soc. C.E.; 24; married; $2^{1}/_{2}$ years engineering experience, surveying, and on design and construction of concrete, earthwork, etc. Has handled men. Graduate civil engineer, 1934. Not afraid to work hard. Desires job giving maximum experience. Available on two weeks notice. Western United States or tropics preferred. C-7-373 A-6-San Francisco.

Civil Engineer; Jun. Am. Soc. C.E.; 27; B.C.E., Polytechnic Institute of Brooklyn; $5^{1}/_{2}$ years in sewer and building construction experience, as contractor's engineer in charge of layout, inspection, time and material reports, 20 state hospital buildings; in charge of field engineering, park department; assistant engineer on design and construction; assistant airport engineer on design and construction of trans-pacific airport bases, Pan-American Airways System. C-8.

Graduate Civil Engineer; Jun. Am. Soc. C.E.; graduate of Carnegie Institute of Technology, 1932; single; 28; about 3 years experience as instrumentman on construction work. About 2 years experience as chief of party with Pennsylvania State Department of Highways. Would like to get into field or design work or a combination of the two. Pittsburgh district preferred. C-10.

Civil Engineer; Jun. Am. Soc. C.E.; 23; single; B.S.E. and C.E., College of the City of New York, 1935; $2^{1}/_{2}$ years as library assistant at C.C.N.Y.; 6 months surveying; $1^{1}/_{2}$ years drafting on city planning survey; good structural and topographical draftsman; desires opportunity in civil engineering. C-17.

Civil Engineer; Jun. Am. Soc. C.E.; 25; single; B.S. in C.E., Massachusetts Institute of Technology, 1933. Majored in structures and sanitation. Experience covers responsible work in topographic and hydrographic surveys, triangulation and adjustment, flood studies and river improvement, also design and supervision of small projects. Available on short notice. C-18.

Civil Engineer; Jun. Am. Soc. C.E.; 28; married; B.C.E., Ohio State University; member of Tau Beta Pi, Sigma Xi; Ohio registration; 5 years highway work; 3 years in direct charge of surveys, plans, construction—mostly bridge and approach work; 3 years (periodic) stream flow work. Desires position with opportunities, not necessarily in line of past experience. C 19.

Miscellaneous

Civil Engineer; Assoc. M. Am. Soc. C.E.; 31; licensed professional engineer and land surveyor, state of Connecticut; B.S. degree, Rhode Island State College, 1927; 9 years with general contractor and state highway department. General building experience. Available immediately. Location anywhere. C-13.

Sales

Civil Engineer; Assoc. M. Am. Soc. C.E.; 46; North Carolina state license; 25 years railroad, highway, and general construction experience as contractor and engineer, and sales manager and manager of ready-mixed concrete and quarry companies; secretary, treasurer, and president of several civic organizations; chairman of many civic committees. Also promotional engineer. C-6.

Teaching

Engineer; M. Am. Soc. C.E.; Society for the Promotion of Engineering Education; M. E. Church; Masonic Lodge; B.S., C.E., and M.S. degrees; registered professional engineer (civil and structural) and surveyor; age 46; 8 years practical experience in various fields; 13 years successful teaching experience (one position); employed at present; desires position teaching civil engineering or applied mechanics, or position with consulting engineer. C-2.

Sanitary and Civil Engineer; Jun. Am. Soc. C.E.; age 29; C.E., M.S.; member of university faculty for 4 years; on staff of state sanitary research laboratory for 2 years; and with consulting sanitary engineer for 4 months. At present supervising research on trade-waste disposal. Available July 1. C-11.

Professor of Civil Engineering; M. Am. Soc. C.E.; licensed professional engineer. B.S.C.E. and C.E. degrees; major work for M.S. completed. Reinforced concrete, structures and highway; 15 years educational experience plus more than 10 years commercial work of major importance. Available as executive or professor of civil engineering. National officer of professional societies, active in publishing and committee work. C-12.

Hydraulic and Civil Engineer; M. Am. Soc. C.E.; licensed professional engineer; B.S.C.E.; over 20 years broad experience in surveying, highways, hydraulics, hydrology, and flood control; research, design, and construction; author and editor of books and special reports; active interest in young engineers; 1 year teaching. University faculty position desired. C-14.

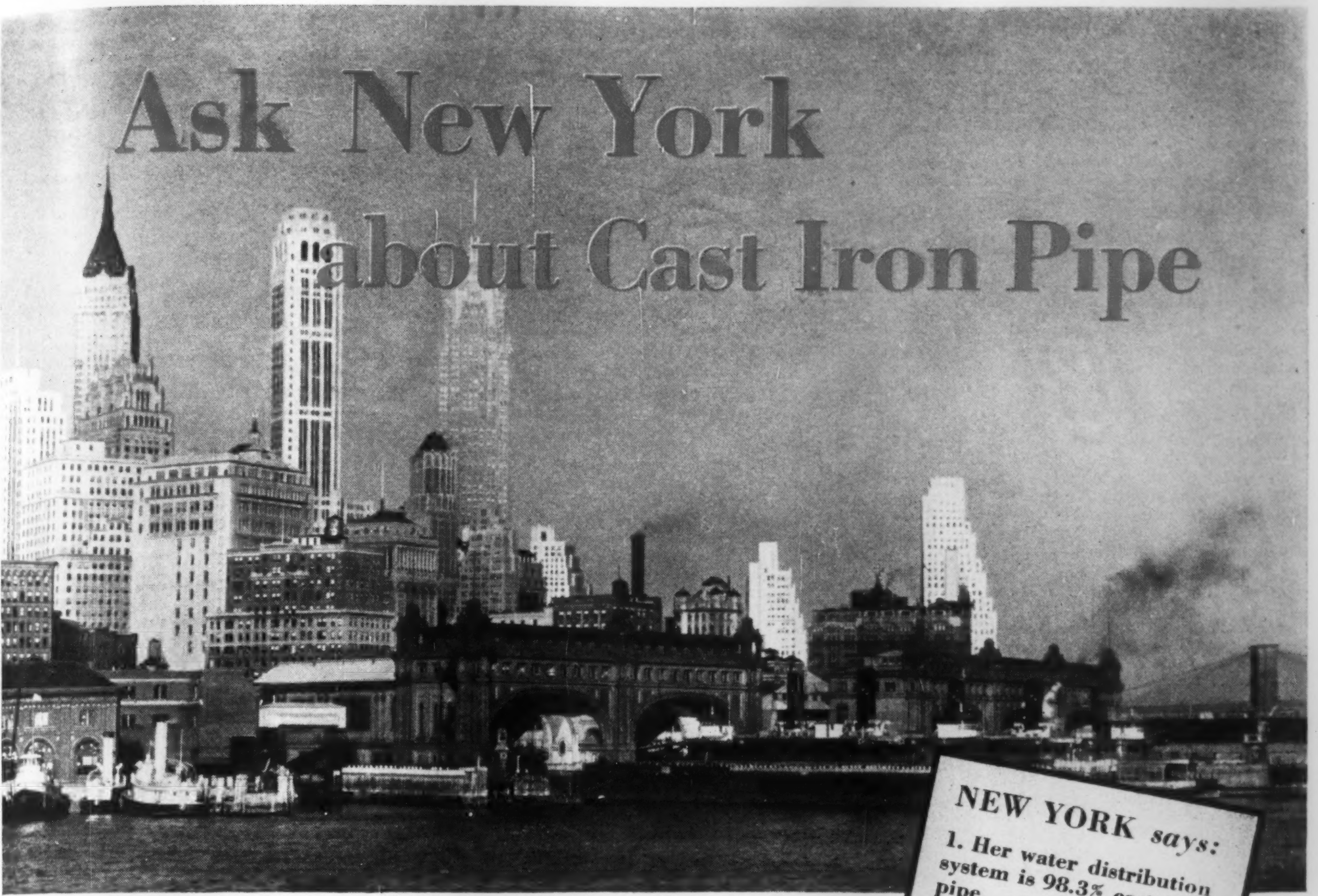
Assistant Professor; Jun. Am. Soc. C.E.; 26; B.S., M.S.; well on toward Ph.D.; Iota Alpha; Sigma Xi; 1 year research fellowship abroad; 3 years as member of research and instructing staff of leading university; 1 year experience with construction corporation. Desires position teaching surveying, mechanics, mathematics, concrete and steel structures, and theory of elasticity. C-24.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1937. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Die Abgekuüzte Wetterbeständigkeitsprobe der Bausteine. By H. Seipp. Munich, R. Oldenbourg, 1937. 62 pp.; illus., diagrs., tables, 10 × 7 in., paper, 3 rm.

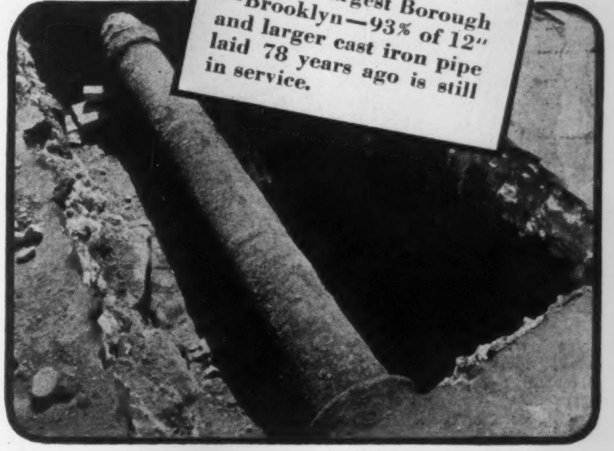
This little book treats of the problem of determining the resistance of building stone to weather and corrosion. The various possible methods of quick testing are described, and methods for the evaluation of various stones are given.



NEW YORK *says:*

1. Her water distribution system is 98.3% cast iron pipe.
2. The oldest cast iron pipe in service was laid 106 years ago.
3. The distribution system contains 4610 miles of cast iron pipe.
4. In the largest Borough—Brooklyn—93% of 12" and larger cast iron pipe laid 78 years ago is still in service.

GRIDIRONED by subways that thread their way through a crowded maze of conduits, the City of New York is a tough testing ground for pipe. With 4610 miles of cast iron pipe in the water distribution system, some of it in continuous service for more than a century, New York has had long and large experience with cast iron pipe. Much of this pipe is meeting conditions of traffic, above and underground, and population congestion, undreamed-of when it was laid generations ago. New York's verdict is this: her water distribution system is 98.3% cast iron pipe. More than 95% of the water distribution systems of our 15 largest cities consists of cast iron pipe. Cast iron is the standard material for water mains. Its useful life is *more than a century* because of its effective resistance to rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust. Available in diameters from 1¼ to 84 inches. For further information, address The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1013 Peoples Gas Building, Chicago, Illinois.



Section of old cast iron water main laid in New York 106 years ago, and still serving.

CAST IRON PIPE

The Standard Material for Underground Mains

TRADEMARK REG.

ATM—Archiv für Technisches Messen. Lieferungen 67 and 68, January-February, 1937. Munich and Berlin, R. Oldenbourg. Illus., diagrs., charts, tables, 12 × 8 in., paper, 1.50 rm. each.

Two numbers of an irregular series of articles upon measurement technique and measuring instruments, intended as a loose-leaf encyclopedia of technical measurement. The material is classified and punched for filing. No. 68 includes an index to the entire series.

Baubeschläge aus Heimischen Werkstoffen. By C. Ehlers. Berlin, VDI-Verlag, 1936. 24 pp., illus., diagrs., tables, 8 × 6 in., paper, 1.50 rm.

This pamphlet reviews briefly the requirements of hardware and other fittings for buildings, and the properties of the usual materials. The book is intended to further the use of domestic materials instead of those which Germany must import.

Berichte des Deutschen Ausschusses für Stahlbau, Ausgabe B, Heft 7. Über das Verhalten Geschweisster Träger bei Dauerbeanspruchung unter Besonderer Berücksichtigung der Schweissspannungen, by G. Bierett. Berlin, Julius Springer, 1937. 21 pp., illus., diagrs., charts, tables, 3.60 rm.

In making welded beams, large welding stresses occur. It has been shown that these have no great effect upon the carrying capacity under static loads, but less is known concerning the effect of dynamic loads. The present report describes experiments to clarify this question.

Blueprint Reading for the Building and Machine Trades. By B. F. Hebberger and C. Nicholas. New York and London, McGraw-Hill Book Co., 1937. 116 pp., diagrs., 10 × 12 in., cloth, $1.80.

This course presents a series of fifty-six drawings of increasing difficulty, with detailed descriptions and questions for the student. It is based on extended teaching experience and is intended for mechanics and students in vocational schools.

(The) Colossus of Roads, a Life of John Loudon McAdam. By R. Devereux. New York, Oxford University Press, 1936. 184 pp. illus., tables, 9 × 6 in., cloth, $3.

This book fills a gap in the history of roads, for there has heretofore been no biography of McAdam. Starting with a spirited sketch of the condition of English roads in the eighteenth century, the author describes McAdam's early life, his years in America, and his efforts as a road builder.

Deep Diving and Submarine Operations, a Manual for Deep Sea Divers and Compressed Air Workers. Compiled and edited by R. H. Davis. London, Saint Catherine Press, 1936. 509 pp., illus., diagrs., charts, tables, 10 × 7 in., cloth, 18 s.

The first section of this volume provides a detailed manual upon the art of deep-sea diving and submarine work, diving apparatus and equipment, submarine metal cutting, blasting, and wreck removal. The second section contains an interesting miscellany of information upon diving for treasure, the salvage of ships and cargoes, escape from disabled submarines, adventures of divers, and the history of diving and diving appliances. The author is an authority in the field.

Economics of the Iron and Steel Industry, 2 Vols. (Bureau of Business Research Monographs, No. 6.) By C. R. Daugherty, M. G. de Chazeau, and S. S. Stratton. New York and London, McGraw-Hill Book Co., 1937. 1188 pp., diagrs., charts, maps, tables, 9 × 6 in., cloth, $12.

"The purpose of this study has been to set forth in considerable detail the economic conditions surrounding the production and distribution of iron and steel in the United States and, in that setting, to present and analyze the major problems of the industry as they manifested themselves in the industry's operations under the Code of Fair Competition for the Iron and Steel Industry, with a view to determining whether that Code or any similar regulatory instrument was or could be made socially advantageous. . . . The analysis and the conclusions reached are applicable only to the iron and steel industry. . . ." In view of the short and disorganized period during which the Code was in force, information has been assembled and analyzed for the period, 1924–1934.

Elementary Soil Fundamentals. By H. S. Gillette. Norman, Oklahoma, University of Oklahoma Press, 1936. 60 pp., illus., charts, tables, 9 × 6 in., paper, 65 cents.

This pamphlet provides a simple presentation of the fundamentals of soil science, which will introduce the student to the new field in a logical way. It affords an inexpensive, practical approach to the subject.

Elements of Railroad Engineering, 5 ed. By W. G. Raymond, revised by H. E. Riggs and W. C. Sadler. New York, John Wiley & Sons, 1937. 406 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $4.25.

The main revision in this new edition of a fundamental work on railroad engineering has been made in the earlier sections. The introductory chapter on history and development has been expanded to several chapters, as a result of the changes in late years. The parts on permanent way (covering rails, roadbed, bridges, yards, and signaling) and on locomotives and other equipment have of course been revised in the light of modern practice. The last section on location, construction, and surveys has been left essentially as it was.

Engineering Properties of Soil. By C. A. Hogentogler and C. A. Hogentogler, Jr. New York and London, McGraw-Hill Book Company, Inc., 1937. 434 pp., illus., tables, diagrs., charts, 9 × 6 in., cloth, $5.

The subject matter of this book is presented as an application of the principles of physics, chemistry, and mechanics included in the undergraduate courses of engineering. The more elaborate mathematical relations have been eliminated in favor of simpler arithmetical and algebraic expressions. General information on the properties of soil in relation to the design and construction of engineering work and descriptions of the utilization of test results in the design of stable, durable, and economic structures have been included.

Further Problems in the Theory and Design of Structures, 2 ed. revised. By E. S. Andrews. London, Chapman and Hall, 1936. 236 pp., diagrs., charts, tables, 9 × 6 in., cloth, 10 s.

This volume is intended to supplement the author's *Theory and Design of Structures* by discussing certain advanced problems omitted from that volume. The method of influence lines, as applied to frames, beams, arches, and suspension bridges, is first presented. The principle of work and its application to deflections of framed structures, redundant frames, and rigid arches are discussed. Finally, the stresses in portals and wind bracings, and the secondary stresses in structures are considered.

Index to A.S.T.M. Standards and Tentative Standards, January 1, 1937, Philadelphia, American Society for Testing Materials. 118 pp., 9 × 6 in., paper, gratis.

This index enables the user to ascertain readily whether the Society has issued standards or tentative standards, test methods, or definitions upon any engineering material or subject, and to locate the volume in which the latest information will be found.

Mathematical Recreations and Essays, 10 ed. By W. W. R. Ball. London and New York, Macmillan & Co., 1931, 366 pp., diagrs., charts, tables, 8 × 5 in., cloth, $3.50.

This is a reprint of an amusing little book which has run through ten editions. It covers arithmetical, geometrical, and mechanical problems, magic squares, and chess and playing card recreations. There are also discussions of cryptographs, ciphers, and various famous calculating prodigies. A good deal of historical information included in earlier editions has been omitted from the later editions.

Mitteilungen aus den Forschungsanstalten GHH-Konzern, Band 5, Heft 1, January 1937. Berlin, VDI-Verlag, 1937. illus., diagrs., charts, tables, 12 × 8 in., paper, 2.70 rm.

In this number Dr. Juenger discusses "increasing the resistance of steel to sea-water corrosion and bending by surface compression, nitriding, case-hardening, and galvanizing." In a second paper, Gustav Mussgnug gives the results of an investigation of the "influence of the burning temperature upon the properties of cement."

Principles of Road Engineering. (The Roadmakers' Library, Vol. 6.) By H. J. Collins and C. A. Hart. London, Edward Arnold & Co.; New York, Longmans, Green & Co., 1937. 628 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $18.50.

This sixth volume in the British series, "The Roadmakers' Library," is very broad in scope. Historical information about road development precedes several chapters on such subjects as traffic movement, economic considerations, maintenance, and route location. Road surveying is given full treatment, with maps and drawings (both ground and aerial work). Other chapters deal with earthworks, subsoil, and drainage. Concrete is the surface given most space, but other road surfaces are treated adequately. Discussions of legal points affecting the highway engineer and of the powers and duties of highway authorities are of special interest.

Recueil de Planches de Béton Armé. Vol. 1, Batiment. By J. Dahin. Paris, Dunod, 1937. 27 pp., 110 plates, illus., diagrs., charts, tables, 11 × 17 in., paper, 126.65 frs.

This volume on reinforced concrete construction is intended to supply practical information to the architect and builder. The first part of the work presents photographs of buildings, which illustrate the chief systems of reinforced concrete construction, and a series of plates giving numerical tables and diagrams used in calculation, as well as various methods of steel reinforcing. The second part presents the principles of reinforced concrete calculation, without calling for a knowledge of advanced mathematics.

Regeln für die Durchflussmessung mit Genormten Düsen und Blenden. VDI-Durchfluss-Messregeln DIN 1952. Berlin, VDI-Verlag, 1937. 23 pp., diagrs., charts, tables, 12 × 8 in., paper, 5 rm.

A new edition of the standards for the measurement of fluid flow by means of orifices and nozzles. A few changes in the rules have been made, and there are certain additions to this edition.

Taschenbuch der Stadtentwässerung. By K. Imhoff. Munich and Berlin, R. Oldenbourg, 1936. 195 pp., diagrs., charts, tables, 7 × 5 in., paper, 5.40 rm.

The principles of sewerage systems and sewage plants are concisely described in this small pocketbook, and a collection of formulas and numerical data needed by designers are provided. The formulas and methods of calculation have been simplified as far as possible, but cover the necessary calculations adequately. This edition has been thoroughly revised and considerably enlarged.

(The) Theory of Continuous Structures and Arches. By C. M. Spofford. New York and London, McGraw-Hill Book Co., 1937. 267 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $3.50.

A textbook covering the theory of the bridge types mentioned in the title. The first part takes up continuous beam, girder, and truss design. The section on arches gives fundamental stress-distribution calculations, then considers two-hinged, three-hinged, and fixed-end arches. The last chapter is on rigid frames. Five appendices give special equation derivations.

U. S. Coast and Geodetic Survey Field Engineers Bulletin. Washington, D.C., U. S. Coast and Geodetic Survey, December 1936. 210 pp., illus., tables, diagrs., charts, $10^{1}/_{2}$ × 8 in., paper.

This volume includes papers on "Velocity and Ray Paths of Sound Waves in Sea Water"; "Cadastral Surveys"; "Rectangular Coordinates"; "Difficulties in First Order Leveling"; "Search for Lost Plane, Great Salt Lake, Utah"; "Use of Color Filters on Geodetic Instruments"; "Bogoslof Island"; and many other subjects.

RECORD BROKEN

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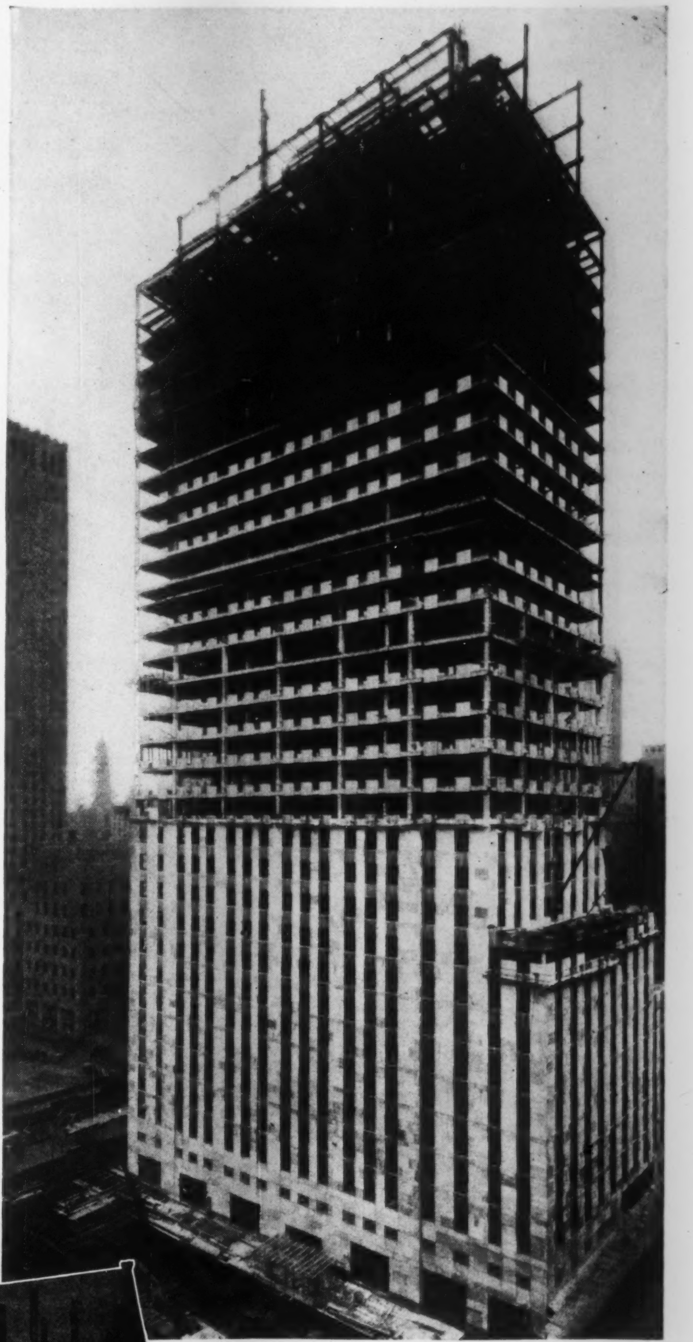
THE 36-story Building No. 5, the latest addition to Rockefeller Center, was erected in 43 working days, establishing a new world's record for skyscraper steel. This record betters the one made some two years ago by the same Steel Erectors, Post & McCord, Inc., in erecting the 41-story Italian Building, likewise a unit of the Rockefeller Group. To meet erection schedules as rigorous as this, fabricating resources — capacity, facilities and organization — must measure up to the exacting demands for ON TIME DELIVERIES in proper sequence and complete to the last detail.

American Bridge Company fabricated the steelwork for both of these buildings, as well as that for the other 9 units which constitute Rockefeller Center — the world-famous building project which to date has required some 110,000 tons of steel.



ONE ERECTION RECORD *overshadows another in this photograph. In the background stands the Italian Building of Rockefeller Center on which the previous record had been made.*

FROM FOUNDATION STEEL *to completion of the structure took only 43.2 days, or a rate of 208.3 tons per day for the total of 8400 tons.*

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UNITED STATES STEEL

CURRENT PERIODICAL LITERATURE

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Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

Concrete, Maintenance and Repairs. Timely Repairs Save Concrete on Burlington. *Ry. Eng. & Maintenance*, vol. 33, no. 2, Feb. 1937, pp. 100–103. Systematic program of repairing all defective concrete bridges adopted by Chicago, Burlington, and Quincy Railroad; methods used.

Concrete Girder, British Columbia. Self-Supporting Reinforcing in Concrete Bridge Girders. *Eng. News-Rec.*, vol. 118, no. 7, Feb. 18, 1937, pp. 270 and 271. Use of light steel trusses as reinforcement for 1,400-ft concrete girder approach of highway bridge being built across Fraser River at New Westminster, B. C.; soft bottom and floor height of 90 ft at river end of approach would have made falsework expensive.

Construction, Accidents. Floor Form Scaffold Crashes Safety Net on Golden Gate Bridge Killing Ten Men. *Eng. News-Rec.*, vol. 118, no. 8, Feb. 25, 1937, p. 313. Description of accident caused by fall of scaffold, about 20 ft wide and 60 ft long, used for stripping forms from underside of concrete floor slab.

Highway, Iowa. Current Bridge Construction in Central Iowa, J. C. Black. *Roads & Streets*, vol. 80, no. 1, Jan. 1937, pp. 33–37. Brief notes on design of various types of highway bridges.

Highway, Traffic Control. Bay Bridge Traffic and Approach Problems, C. H. Purcell, C. E. Andrew, and G. B. Woodruff. *Eng. News-Rec.*, vol. 118, no. 9, Mar. 4, 1937, pp. 331–335. Planning for 12,000 vehicles per hour on San Francisco–Oakland Bay Bridge and for handling traffic at either end; financing and major contracts on bridge approaches; grade separations on bridge approaches; distribution structure.

Piers, Foundations. Senkkastengruendungen und Beurteilung der tragenden Schicht, W. Loos. *Bauingenieur*, vol. 117, nos. 39/40, Oct. 2, 1936, pp. 418–420. Review of special advantages of caisson foundations for bridge piers; geological methods and tests for determining dependability of underlying strata and methods of improving them for insuring adequate support for caissons.

Railroad. Concrete and Steel in Trestle Construction, R. P. Hart. *Ry. Eng. & Maintenance*, vol. 33, no. 1, Jan. 1937, pp. 33–34. Reasons for substituting concrete and steel for wood in smaller railroad trestles; design of three-pile concrete bent by Missouri Pacific Railroad. Before Am. Ry. Bridge & Bldg. Assn.

Steel Truss, Pre-Stressing. Pre-Stressing Bridge Girders. H. J. Nichols. *Instn. Civ. Engrs.—Advance Paper*, no. 5076, 1937, 50 pp., 3 supp. plates. Description of pre-stressing methods used in construction of steel-truss railroad girders, 288 ft long, for long bridge over Nerbudda River at Broach, India; theory and procedure of prestressing; results of experiments on models.

Suspension. Haengebruecken von vielen Spannweiten mit Versteifungskabeln, E. Kuester. *Assn. Internationale des Ponts et Charpentes—Memoires*, vol. 4, 1936, pp. 367–377. Multispan suspension bridges with stiffening cables; methods of calculation given; it is pointed out that in United States greater deflections are permissible than in Europe, and with justification. (In German, with brief abstracts in French and English).

Suspension, San Francisco–Oakland Bay. Construction History of San Francisco Bay Bridge, C. E. Andrew. *Calif. Highways & Pub. Works*, vol. 15, no. 2, Feb. 1937, pp. 10–11, and 20. Review of construction of San Francisco–Oakland Bay Bridge and Yerba Buena Island tunnel. Excerpts from address before Am. Assn. of State Highway Officials.

Wooden. Lake Pontchartrain Trestle, W. B. Gregory. *Ry. Eng. & Maintenance*, vol. 33, no. 2, Feb. 1937, pp. 108–110. History and present condition of historic structure built in 1882 of creosoted yellow pine timber.

Wooden, Port Angeles, Wash. Viaducts with Composite Deck and 100-Ft Treated Timber Towers. *Wood Preserving News*, vol. 15, no. 9, Sept. 1936, pp. 104–107, and 114–115. Two treated timber bridges in Port Angeles, Wash.; each is over 750 ft long and has combined timber and concrete decks and framed timber towers.

Wooden, Standards. Report of Committee VII-Wood Bridges and Trestles. *Am. Ry. Eng. Assn.—Bul.*, vol. 38, no. 390, Oct. 1936, pp. 183–186, 9 supp. sheets. Design of wooden trestles for heavy loading; bearing power of wooden piles; recommended relationships between energy of hammer and weight or mass of pile for proper driving, including concrete piles; improved design of timber structures to give longer life with lower cost of maintenance.

Wooden, Wrecking. Dynamiting Old Timber Trusses Adjacent to New Concrete Span. *Eng. News-Rec.*, vol. 118, no. 7, Feb. 18, 1937, p. 271. Use of 30 charges of 60 per cent dynamite inserted in members of timber truss bridge, with 140-ft span, at Estacada, Ore., to drop 112-ft length of structure into Clackamas River, without damage to new concrete span immediately upstream.

BUILDINGS

Steel, Design. Rational Design of Steel Building Frames, J. F. Baker. *Instn. Civ. Engrs.—J.*, no. 7, June 1936, pp. 127–210, (discussion) 211–230, 4 supp. sheets. Review of existing methods of design; tests on existing buildings; detailed investigation of behavior of connections; evolution of method of design; effect of wind loads; application of method of design.

CONCRETE

Cement Plants, Pennsylvania. Winter Weather No Handicap in Erection of Concrete Structures, E. Gruenwald. *Pit & Quarry*, vol. 29, no. 7, Jan. 1937, pp. 102–104 and 107. Construction of crusher building and rock storage building at plant of Lone Star Cement Corp., Nazareth, Pa.

Construction, Cold Weather. Steam Heating Plant Warms Concrete Aggregate. *Eng. News-Rec.*, vol. 118, no. 7, Feb. 18, 1937, p. 273. Use of two 40-hp steam boilers and steam circulating system for heating of materials, stockpiles, and concrete mixing plant in construction of lining for Mono Craters tunnel of Los Angeles water works.

Defects. Surface Defects of Formed Concrete, S. Comess. *Military Engr.*, vol. 29, no. 163, Jan.-Feb. 1937, pp. 48–49. Results of tests made by Rock Island District in construction of Mississippi River locks and dams to determine causes of formation of air bubbles and sandstreaking.

Design. Recueil de Planches de Béton Armé, J. Dahin. Paris, Dunod, 1937. Vol. 1, 27 pp., 110 plates, figs., diagrs., charts, tables. Collection of data for design of concrete foundations, slabs, girders, frames, arches, etc., also of various structures such as roofs, reservoirs, silos, etc.; general principles of concrete design.

Modern Methods. Design Modernization and Cements Dominate Concrete Meeting. *Eng. News-Rec.*, vol. 118, no. 9, Mar. 4, 1937, pp. 340–343. Review of proceedings of 1937 convention of American Concrete Institute, including abstracts of papers and discussions on concrete in Europe, cement developments, portland pozzuolan cements, concrete repair, vibration of pavement concrete, and structure design; joint committee report; committee activities.

Plasticity. Effect of Plastic Flow and Volume Changes on Design, C. T. Morris. *Am. Concrete Inst.—J.*, vol. 8, no. 2, Nov.-Dec. 1936, pp. 123–128. Progress of Committee 313 of American Concrete Institute, indicating how volume changes in certain simple members and structures will affect stress distribution in them and amount and location of reinforcing.

Testing, Workability. Betonzusammensetzung und Verarbeitbarkeit. K. Walz. *Beton u Eisen*, vol. 35, no. 18, Sept. 20, 1936, pp. 296–304. Results of tests, at Stuttgart Materials Testing Laboratory, on effect of composition of concrete mixes on workability of concrete.

DAMS

Cofferdams, Construction. Pile Pulling and Re-Use Cuts Cofferdam Cost. *Eng. News-Rec.*, vol. 118, no. 9, Mar. 4, 1937, pp. 327–328. Large economies made in construction of Pickwick Landing Dam of Tennessee Valley Authority, by use of same steel sheet piling for all three cofferdams; pulling and reconditioning piles; features of special pulling outfit.

Concrete Arch, Algeria. Barrage en Béton armé à voutes multiples sur l'Oued-Ksob, M. Alexandre. *Technique Moderne*, vol. 29, no. 1, Jan. 1, 1937, pp. 1–8. Description of reinforced concrete multiple-arch dam, with maximum height of 46 m and crest length of 260 m, under construction on Oued-Ksob in southern Algeria; layout of construction camp and equipment; design of concrete mix; vibrating of concrete; construction of cutoff.

Concrete Gravity, Temperature Measurement. Madden Dam Concrete Temperatures, N. H. Wilson. *Military Engr.*, vol. 29, no. 163, Jan.-Feb., 1937, pp. 59–61. Types of instruments and methods used in measuring temperatures of concrete during construction of Madden Dam over Chagres River, Isthmus of Panama.

Hydraulic Fill, Spillway. Fort Peck Dam Spillway, J. R. Hardin. *Military Engr.*, vol. 29, no. 163, Jan.-Feb. 1937, pp. 24–28. Design, excavation, and construction of concrete-lined spillway 4,700 ft long and from 800 to 130 ft wide; gate structure details.

Hydraulic Fill, Tunnels. Fort Peck Dam Tunnels, A. W. Pence. *Military Engr.*, vol. 29, no. 163, Jan.-Feb., 1937, pp. 18–23. Method of construction of four tunnels 24 ft 8 in. in diameter and 600 ft long; salient features of design; construction of control shafts.

Landslides, Control. Refrigeration Holds Sliding Silt in Construction of Grand Coulee Dam, J. A. Newton. *Ice & Refrig.*, vol. 92, no. 2, Feb. 1937, pp. 77–79. Freezing produced by mechanical refrigeration of arch to prevent glacial silt slide in construction of dam.

Movable. Les barrages mobiles modernes, V. Cherre. *Technique Moderne*, vol. 28, no. 23, Dec. 1, 1936, pp. 809–816. General outline of design principles on which movable dams are based; description of various dams constructed in Sweden, France, and Germany.

Reservoirs, Leakage. Checking for Leakage from Reservoirs. *Water Works Eng.*, vol. 90, no. 3, Feb. 3, 1937, pp. 165–166. Methods used by water-works superintendents for checking leakage from reserviors and for location of serious leaks.

Reservoirs, Outlets. High Pressure Gates for Outlet Works. *U. S. Bur. Reclamation—Specifications*, no. 723, 1937, 24 pp., 35 supp. plates. Invitation for bids, schedule, specifica-

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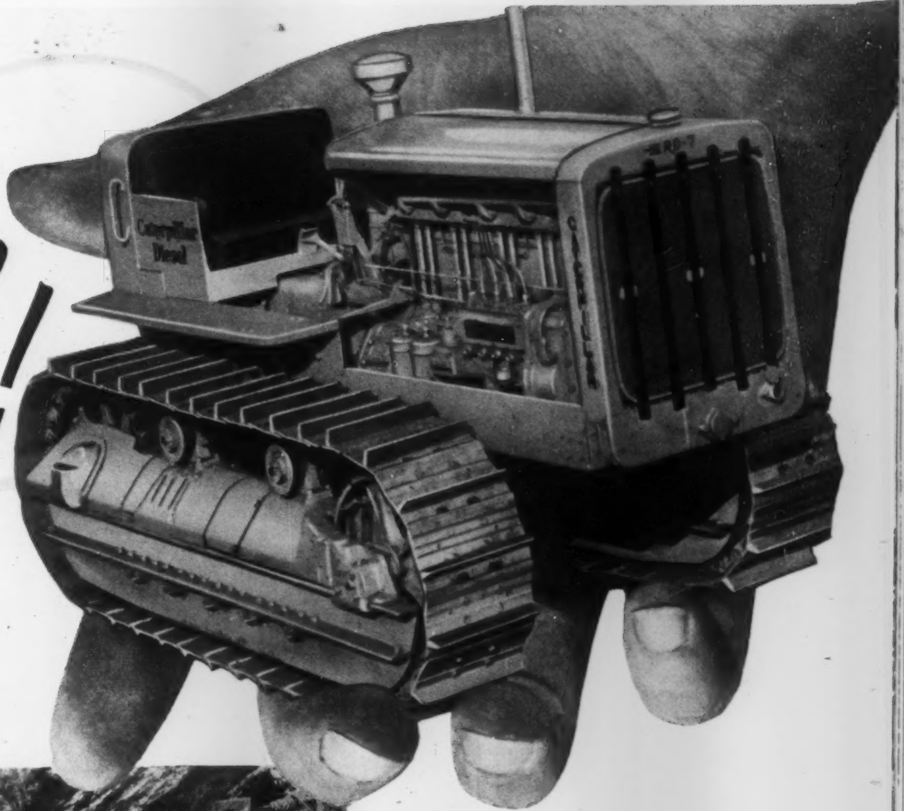

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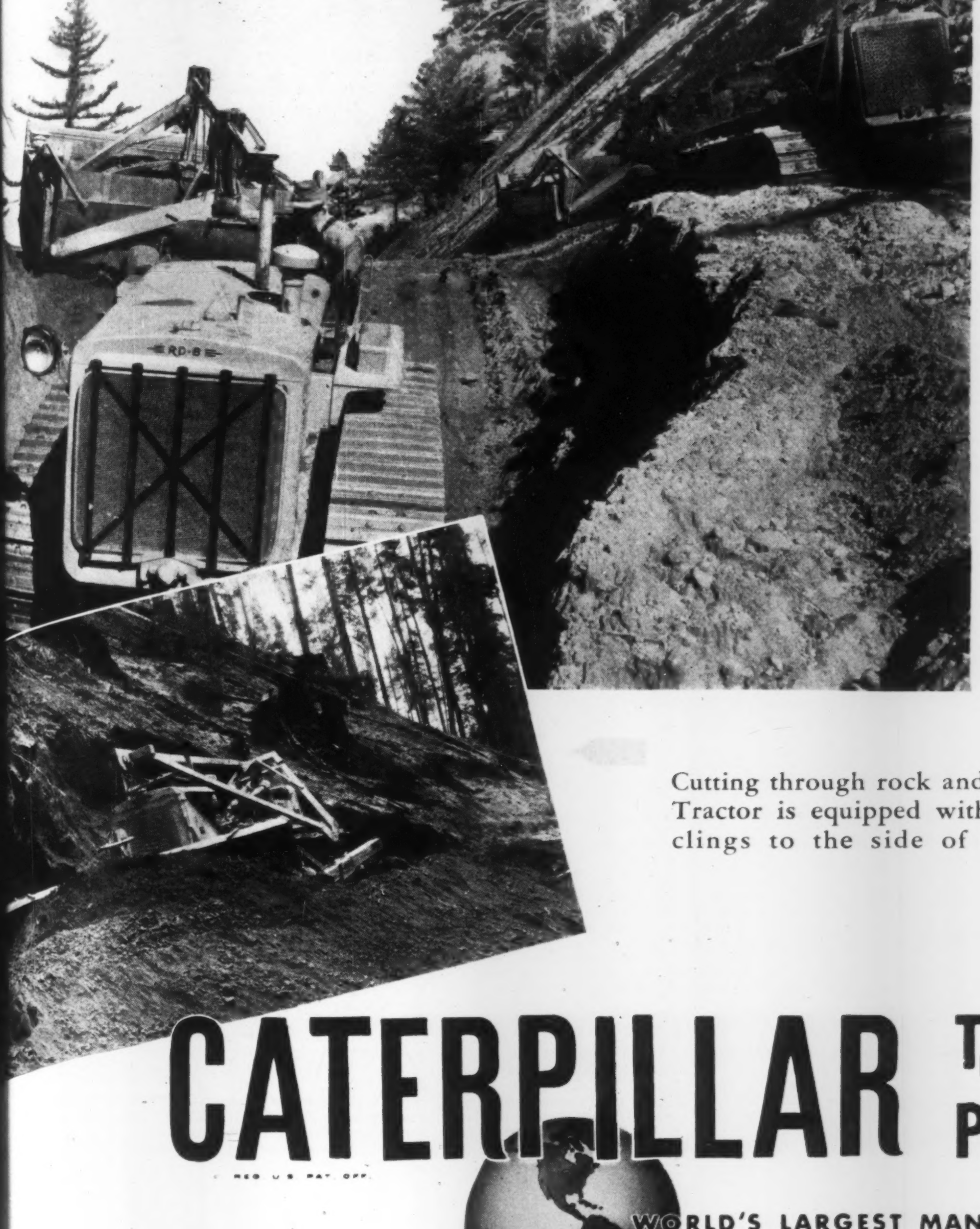

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tions, and drawings for high-pressure gate assemblies for installation in outlet works at Caballo Dam (Rio Grande project, New Mexico–Texas), and at Grassy Lake Dam (Upper Snake River Project, Idaho).

Weirs, Broad-Crested. Theory of Broad-Crested Weir, B. M. Bharadwaj. *Indian Eng.*, vol. 100, no. 6, Dec. 1936, pp. 202–204. Experimental formulas.

FLOOD CONTROL

Department Stores, Flood Protection. Superflood Bulkheads Installed in Pittsburgh Department Store. *Eng. News-Rec.*, vol. 118, no. 7, Feb. 18, 1937, pp. 254–256. Description of private flood-protection system of the Joseph Horne Company store to resist 12-ft head against its show windows by means of aluminum panels moved into place on trolleys; supplementing drainage and pump system in basement; strengthening of sidewalk.

Spillways. Spillway Cuts Crest of New Orleans Flood, H. W. Richardson. *Eng. News-Rec.*, vol. 118, no. 8, Feb. 25, 1937, p. 314. Performance of Bonnet Carré spillway in lower Mississippi Valley during record flood of Jan. and Feb. 1937; spillway, nearly full, cuts flood crest 3 ft; flow in floodway reaches 200,000 cu ft per sec.

United States. River Goes Wild, E. J. Tangerman. *Power*, vol. 81, no. 3, Mar. 1937, pp. 172–174. Preliminary report of flood effects and conditions in Ohio Valley.

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Weirs, Design. Determination of Water Profiles Over Weirs and Flumes, S. K. R. Pandit. *Indian Eng.*, vol. 100, no. 6, Dec. 1936, pp. 192–200, supp. plate. Determination by use of backwater curves; calculations of uniform width and uniform negative slope, variable negative slope, positive slope, friction effect. Bibliography.

FOUNDATIONS

Piles. Rigid Machine Foundations Supported by Creosoted Piles. *Wood Preserving News*, vol. 15, no. 1, Jan. 1937, pp. 12–14. Type of pile foundations used for heavy machinery in Eddystone plant of General Steel Castings Company, Chester, Pa.

Piles, Concrete. Piling Casting Method Saves Forms and Storage Space. *Eng. News-Rec.*, vol. 118, no. 8, Feb. 25, 1937, p. 307. Making 900 tapered concrete piles about 25 ft long, by casting them in layers and in two operations, for foundations of extension to municipal power plant at Kansas City, Kans.

Soils, Testing. Shearing Resistance of Soils, L. F. Cooling and D. B. Smith. *Instn. Civ. Engrs.—J.*, June 1936, pp. 333–343, 2 supp. sheets. Report of Subcommittee on Earth Pressures of Institution of Civil Engineers; equipment and methods used in study of shear strength of clay soils; torsional shear tests; compression tests; relation between compressive strength and water content for undisturbed and remolded samples of London clay; practical application.

Tests. Subsoils, Foundations, and Settlements, B. Frisby. *Power & Works Engr.*, vol. 32, no. 371, Feb. 1937, pp. 57–59. Notes on examination of ground and bearing tests; tables showing safe bearing pressures for subsoils.

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Laboratories, United States. University of Minnesota Constructs Hydraulic Laboratory at St. Anthony Falls, L. G. Straub. *Minn. Federation Arch & Eng. Soc.—Bul.*, vol. 21, no. 12, Dec. 1936, pp. 3–6. Description of new hydraulic laboratory having available head of 48 ft and equipped to handle rates of flow in excess of 135,000 gpm.

HYDROLOGY AND METEOROLOGY

Soils, Erosion. Conditions Influencing Erosion on Boise River Watershed, F. G. Renner. *U. S. Dept. Agriculture—Tech. Bul., No. 528*, Oct. 1936, 32 pp. Study of erosion on Idaho watershed of 1,700,000 acres; evidences of erosion on watershed; characteristics of watershed; methods of study; influence of gradient, aspect, soil, plant type, density of vegetation, rodent infestation, and accessibility to livestock; application of results.

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Rivers, Hydraulics. Tidal Model of River Great Ouse and Wash, D. B. O'Shea. *Instn. Mun. & County Engrs.—J.*, vol. 62, no. 26, June 23, 1936, pp. 1500–1516. Construction of distorted laboratory model for testing of proposed river improvements; surveys and experimental work; correlation of estuary and model; velocity and direction observations; silt samples; selection of material for erodible bed.

Rivers, Improvement. Cutoffs Lower Flood Crest. *Eng. News-Rec.*, vol. 118, no. 7. Feb. 18, 1937, pp. 265–267. Observations on record flood of January 1937, showing that twelve new channels across the Mississippi River bends below Arkansas City increase the velocity sufficiently to reduce flood heights by several feet at upper end of cutoff area; profile of west bank levee and flood levels for 36 miles below Arkansas City; hydraulic laboratory tests.

IRRIGATION

Canals, Construction. All-American Canal Progress. *Eng. News-Rec.*, vol. 118, no. 7, Feb. 18, 1937, pp. 258–261. Progress report on construction of All-American Canal in California, 80 miles long, involving moving about 60,000,000 cu yd of excavation; excavating with buckets of 16-cu yd capacity; siphon design; compacting canal lining; typical canal sections; typical inlet into main canal.

Canals, Silt. Why Desilting Works for All-American Canal? C. P. Vetter. *Eng. News-Rec.*, vol. 118, no. 9, Mar. 4, 1937, pp. 321–326. Origin of 70,000 tons of silt per day, which desilting works at Imperial Dam are designed to remove; silt content curves of Colorado River; silt sampler; retrogression of river bed; amount and character of silt load at Imperial Dam site before and after closure of Boulder Dam.

Flumes, Sheet Metal. Constructing Economical Mine Flume, F. A. Crampton. *Min. J. (Phoenix, Ariz.)*, vol. 20, no. 18, Feb. 15, 1937, pp. 3–4. Notes on use of metal sheets, usually 4 ft wide and 12 ft long, for water flumes; 22-gage galvanized sheets are suitable for small flumes and heavier metal for larger types; details of procedure in construction of flume and supports; crew organization.

LAND RECLAMATION AND DRAINAGE

Drainage Systems. Ship-Canals Utilized for Drainage, L. R. Wentholt. *Instn. Civ. Engrs.—J.*, no. 2, Dec. 1936, pp. 221–244, (discussion) 245–254. Discussion of advantages and disadvantages of Netherlands practice of utilizing navigation canals for drainage; permissible velocity of current in ship canal; inflow structure for Bolksbeek; spillway at lock near Zutphen; small inlet structures.

Italy. La bonifica del Sele, F. Scalesse. *Annali dei Lavori Pubblici*, vol. 74, no. 12, Dec. 1936, pp. 998–1005. Description of Sele Basin reclamation project on east coast of Italy, occupying area of over 41,000 ha and including concrete dam, flume, etc.

PORTS AND MARITIME STRUCTURES

Breakwaters, Wave Effect. Sull'azione delle onde contro le opere marittime di difesa a parete verticale, G. Ferro. *Annali dei Lavori Pubblici*, vol. 74, nos. 10 and 12, Oct. 1936, pp. 764–781, and Dec., pp. 935–946. Theory of impact of waves on vertical-face breakwaters and seawalls; review and analysis of recent experimental determinations in Mediterranean Sea. Bibliography.

Naples, Italy. La sistemazione del porto di Napoli in Regime fascista, F. Gangemi. *Annali dei Lavori Pubblici*, vol. 74, no. 10, Oct. 1936, pp. 808–818. Description of recent improvements in port of Naples, Italy, including new breakwater, 343 m long, and extension of mole 400 m long; new dock; cargo-handling equipment.

Shore Protection. Protecting North Carolina Beaches Against Wind and Wave Erosion, H. E. Weatherwax. *Eng. News-Rec.*, vol. 118, no. 9, Mar. 4, 1937, p. 330. Use of brush fences for prevention of wind and sea erosion on 175 miles of sand beaches in North Carolina. Abstract of paper before Am. Shore & Beach Preservation Assn.

ROADS AND STREETS

Bituminous. Design and Construction of Thin Surfacings, E. G. Wace. *Roads & Road Construction*, vol. 15, no. 169, Jan. 1, 1937, pp. 9–12, (discussion) 12–13. General discussion of requirements, types, and general principles of construction; Ministry of Transport trial sections. Before Road & Bldg. Materials Group of Soc. Chem. Industry.

Bituminous, Low Cost. How to Build Low-Cost Bituminous Roads. *Pub. Works*, vol. 68, no. 1, Jan. 1937, pp. 20–42. Résumé of good construction methods for principal types of low-cost roads; important development in equipment and procedure.

Bituminous, Michigan. Low-Cost City Pavements Developed with Tar, G. H. Sandenburgh. *Am. City*, vol. 52, no. 2, Feb. 1937, pp. 59–61. Experience of Ann Arbor, Mich., with road-mix method.

Bituminous, Missouri. Bituminous Stabilized Base Construction in Missouri, J. C. Black. *Roads & Streets*, vol. 80, no. 2, Feb. 1937, pp. 29–32. Use of traveling plant mix method on 7 miles of road 22 ft wide.

Causeways. Embankment of Mare Island Causeway, L. N. Moeller. *Military Engr.*, vol. 29, no. 163, Jan.-Feb. 1937, pp. 31–34. Operations and quantity estimates for 2,469-ft Vallejo approach embankment of 4,478-ft causeway from Vallejo to Navy Yard at Mare Island, Calif.; use of overburden method.

Concrete, Ice Removal. Effect of Calcium and Sodium Chlorides on Concrete When Used for Ice Removal. *Am. Concrete Inst.—J.*, vol. 8, no. 2, Nov.-Dec. 1936, pp. 107–122. Progress report on experimental study by Portland Cement Association, dealing with methods of treating surface of existing concrete pavements to prevent scaling, and with factors which reduce tendency of concrete surfaces to scale when subjected to calcium and sodium chloride applications; freezing and thawing tests; tests of slabs frozen with bottoms wet; tests of old concrete; wetting and drying tests.

Construction. Difficult Rock Blasting Job Widens Road at Oregon City, E. A. Collier. *Eng. News-Rec.*, vol. 118, no. 8, Feb. 25, 1937, p. 301. Removal, by means of blasting, of rock layer 20 ft thick from face of basalt cliffs 120 ft high in close proximity to railroad and factory buildings; difficult underpass work.

Highway Crossings, Gas Pipe Lines. Twelve-Inch Main Pierces 164-Foot Embankment. *Am. Gas J.*, vol. 146, no. 2, Feb. 1937, p. 48. Brief description of job with "Hydrauger," ordinarily used to bore under 50-ft city streets; section of Highway Route 29 in New Jersey crossed by Elizabethtown Consolidated Gas Company, of Elizabeth, N.J., shortening construction time by one week with estimated saving of $4,000.

Highway Systems, Mississippi. $42,500,000 Road System Started from Scratch. *Eng. News-Rec.*, vol. 118, no. 9, Mar. 4, 1937, pp. 335–339. State of Mississippi is building 2,715 miles of paved roads; designs show notable inventiveness in details and wide range of alternative sections; center joint designs; dowel assembly to insure alignment and fixity; grading work; progress of work.

Highway Systems, Pennsylvania. One Hundred Million to Pay for Obsolescence, A. J. Bedard. *Eng. News-Rec.*, vol. 118, no. 8, Feb. 25, 1937, pp. 304–305. Review of outgrown road facilities in Pennsylvania forecasting reconstruction task that faces all states; new requirements to meet new conditions introduced by motor vehicles call for new highway systems.

Maintenance and Repair, County. County Highway Maintenance Methods and Organization, H. G. Sours. *Pub. Works*, vol. 68, no. 2, Feb. 1937, pp. 32 and 34–36. Review of organization; variations in operations, equipment, types of treatment, snow and ice removal, and roadside beautification. Before Am. Road Bldrs'. Assn.

Maintenance and Repair, Methods. How to Maintain Highways and Streets. *Pub. Works*, vol. 68, no. 2, Feb. 1937, pp. 37–38, and 40–41. Important details of maintenance work and suggested methods and procedure for unusual problems.

Railroad Crossings, Elimination. Elimination of Level Crossings in North America. *Ry. Gaz.*, vol. 65, no. 26, Dec. 25, 1936, pp. 1060–1061, and 1070–1071. Extent of crossing elimination in Syracuse, N.Y., and London, Ontario.

Slipperiness. Studies in Road Friction. I—Road Surface Resistance to Skidding, G. Bird and W. J. O. Scott. (Great Britain) *Dept. Sci. & Indus. Research & Ministry of Transport—Road Research—Tech. Paper, No. 1*, 1936, 66 pp., 6 supp. sheets. Is. 6d. net. Study of road aspect of skidding, reporting experimental work of Road Research Laboratory at Harmondsworth, England, and summarizing results of very large number of measurements of friction of tires on roads of various types under various climatic conditions and speeds. Bibliography.

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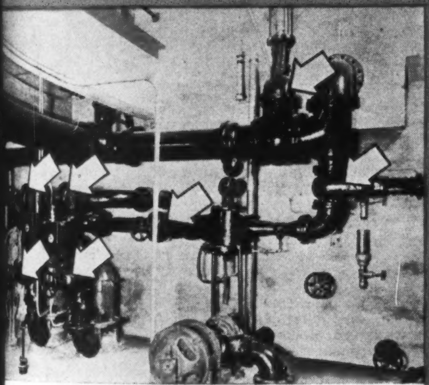

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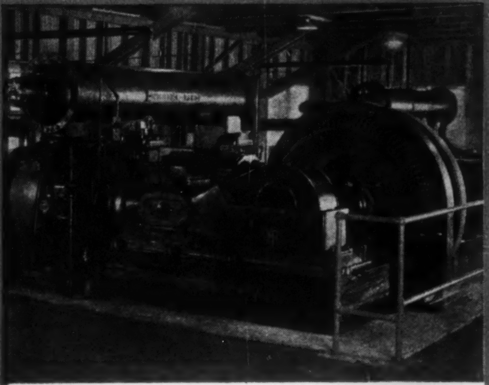

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TESTING. New Bumpograph Devised for Asphalt Concrete Pavement, E. L. Seitz. *Calif. Highways & Pub. Works*, vol. 15, no. 2, Feb. 1937, pp. 26–27. Features of author's so-called "bumpograph" consisting of wooden frame supported by bicycle wheel at each end and two wheels at middle hinge where marking device is located.

SEWERAGE AND SEWAGE DISPOSAL

BOSTON, MASS. Extension of Sewage Disposal Facilities Recommended for Boston Area. *Eng. News-Rec.*, vol. 118, no. 8, Feb. 25, 1937, pp. 292–293. Abstract of recent report, finding that pollution in Boston Harbor is increasing, and urging that improved disposal facilities be planned; estimated cost of partial treatment.

CHEMICAL PROCESS. Symposium on Chemical Methods of Treating Sewage. *Instn. Chem. Engrs.—Paper Mtg.*, Feb. 17, 1937, 28 pp. British Practice, J. H. Garner; American Practice, H. H. Hendon; German Practice, K. Imhoff. Bibliography.

GREAT BRITAIN. Inauguration of West Middlesex Main Drainage Scheme, K. Wood. Middlesex County Council. Oct. 23, 1936, 59 pp., figs., diagrs., charts, tables. Description of recently opened sewage-disposal system west of London, serving population of about 1,000,000; details of Mogden purification works.

PLANTS, STAINLESS STEEL. Stainless Steel in Sewage Treatment, C. C. Snyder. *Mun. Sanitation*, vol. 8, no. 2, Feb. 1937, pp. 134–135. Properties of stainless steel, making it especially applicable for the equipment of sewage-disposal plants.

PROVIDENCE, R.I. Remodeling Providence Sewage Plant with Modern Equipment Saves Money. *Pub. Works*, vol. 60, no. 2, Feb. 1937, pp. 9–11. Construction and equipment details of activated sludge plant for population of 252,000.

SLUDGE. Determining When to Draw Sludge. *Mun. Sanitation*, vol. 8, no. 2, Feb. 1937, pp. 152–153. Discussion by superintendents of means used to determine when to draw sludge and suitability of sludge for efficient drying.

ST. CHARLES, ILL. 1936 Model Sewage Disposal Plant, R. A. Orput. *Pub. Works*, vol. 68, no. 1, Jan. 1937, pp. 11–12. Design details of plant, with capacity of 1 mgd, for city of 7,400 inhabitants.

UNITED STATES. Status of Sewage and Industrial Wastes Disposal in U. S. *Mun. Sanitation*, vol. 8, nos. 1 and 2, Jan. 1937, p. 104, and Feb., pp. 147–148. Continuation of series of articles by state sanitary engineers reviewing present status in their respective states. January: Florida, T. S. Kennedy. February: South Dakota, W. W. Towne; Georgia, W. H. Weir.

STRUCTURAL ENGINEERING

ARCHES, MASONRY. Mechanics of Voussoir Arch, A. J. S. Pippard, E. Tranter, and L. Chitty. *Instn. Civ. Engrs.—J.*, no. 2, Dec. 1936, pp. 281–306. Results of experimental study by Civil Engineering Department of Imperial College of Science and Technology; accepted basis of design; experiments on two-pinned arch when span is kept constant and on two-pinned arch with abutments spread or contracted; ultimate failure of two-pinned arch; experiments on fixed-end arch with abutments spread or contracted; multiple loads on arch.

CONCRETE SLABS, DESIGN. Simplified Computations for Two-Way Slabs. *Eng. News-Rec.*, vol. 118, no. 7, Feb. 18, 1937, pp. 268–269. Tables and diagrams developed to apply design method given in the new building code of the American Concrete Institute; design procedure for moments and shears.

FRAMED STRUCTURES, CONTINUOUS. Short Method for Computing Moments in Continuous Frames, S. C. Hollister. *Am. Concrete Inst.—J.*, vol. 8, no. 2, Nov.-Dec. 1936, pp. 147–169. Outline of simplified procedure based on method of slope-deflections for approximate determination of moments arising from action of frame as a whole; symmetrical and unsymmetrical loading; loaded member with fixed end; application of unit frame to frame analysis; position of live load for maximum and minimum moments; beams with haunches and curved soffits; numerical examples.

FRAMED STRUCTURES, DESIGN. Method of Successive Increments and Its Applications to Problems on Rigid-Frame Structures, H. Yu Wuchang. China, National Wuhan University Press, 1936. 77 pp., diagrs., charts, tables. Outline of method applied to theory of rigid-frame structures; wind stresses; vierendeel girder; secondary stresses in bridge trusses; problem of tall building frames; determination of moment at any point on vierendeel girder. (In English.)

STRUCTURAL DESIGN, MODELS. Simple Experimental Solutions of Certain Structural Design Problems, A. J. S. Pippard and S. R. Sparkes. *Instn. Civ. Engrs.—J.*, no. 1, Nov. 1936, pp. 79–92. Experience with improved Beggs method of structural models; displacements of points on model made sufficiently large to be measured by ordinary apparatus; working of method illustrated by determination of influence line for reaction in continuous beam, influence line of thrust for two-pinned segmental arch, etc.

VIBRATIONS. Vibration in Industry, J. P. Den Hartog. *J. Applied Physics*, vol. 8, no. 2, Feb. 1937, pp. 76–83. Author discusses vibrations in machines, instruments, and equipment; description of modern methods and instruments for their measurements. Bibliography. Before Founder Soc. Am. Inst. Physics.

WALLS, SOUNDPROOFING. Sound Insulation of Single and Complex Partitions. J. E. R. Constable and G. H. Aston. *Lond., Edinburgh, & Dublin Philosophical Mag. & J. Science*, vol. 23, no. 152, Jan. 1937, pp. 161–181. Results of measurements made at National Physical Laboratory of sound-insulating value of number of partitions; curves of correlation between sound insulation and weight of single homogeneous partitions; principles that should be adopted in sound-insulating constructions.

WIND STRESSES. L'azione del vento sulle costruzioni, R. Giovannozzi. *Ricerche di Ingegneria*, vol. 4, nos. 5 and 6, Sept.-Oct. 1936, pp. 105–121, and Nov.-Dec. pp. 129–141. Review of recent studies of effect of wind on engineering structures, including experiments on models; effect of wind on structural frames and on solid walls; effect of wind on cylindrical structures. Bibliography.

CONSTRUCTION. Mono Craters Tunnel, T. E. Daniels. *Compressed Air Mag.*, vol. 42, no. 2, Feb. 1937, pp. 5253–5254. Work on 11.3-mile tunnel bored through volcanic formation to form part of water-supply system for Los Angeles, Calif.

PROGRESS. Progress in San Jacinto Tunnel. *Eng. News-Rec.*, vol. 118, no. 8, Feb. 25, 1937, pp. 302–304. Tunnel-driving progress in headings between Cabazon and Potrero shafts since pioneer bores were started; about $5^{1}/_{2}$ miles yet to be driven; inclined adit being driven to supplement main headings and pioneer bores; west portal serves now as drainage vent.

VEHICULAR, OREGON. Construction Methods on Tooth Rock Tunnel, H. W. Young. *Roads & Streets*, vol. 80, no. 2, Feb. 1937, pp. 68 and 70. Construction of Tooth Rock Tunnel at Bonneville Dam; 827 ft long; 21 ft 7 in. high; 34 ft wide; radius 17 ft from spring-line.

WATER PIPE LINES

CROSS-CONNECTIONS. Supervision of Cross-Connections by New Jersey State Department of Health, J. B. Baty. *Am. Water Works Assn.—J.*, vol. 28, no. 12, Dec. 1936, pp. 1885–1895. Review of acts, regulations, and recommendations.

WATER RESOURCES

UNDERGROUND, POLLUTION. Occurrence of Ground Water with Reference to Contamination, A. G. Fiedler. *Am. Water Works Assn.—J.*, vol. 28, no. 12, Dec. 1936, pp. 1954–1962. Classification of rocks; relationship of interstices to transmission of contamination; principles of occurrence; water-table conditions; artesian conditions; rate and direction of movement of ground water; effect of pumping.

WATER TREATMENT

BACTERIOLOGY. Direct Plating Method for Determination of Potability of Water, H. B. Schulhoff and H. Heukelekian. *Am. Water Works Assn.—J.*; vol. 28, no. 12, Dec. 1936, pp, 1963–1974. Study of new method for determination of small numbers of B. Coli, consisting essentially in centrifuging water in presence of kaolin or infusorial earth followed by decantation and smearing of residue on E.M.B.-crystal violet agar after method of Gehm and Heukelekian. Bibliography.

CHLORINATION. Residual Chlorination on Los Angeles System, R. F. Goudey. *Am. Water Works Assn.—J.*, vol. 28, no. 11, Nov. 1936, pp. 1742–1755. Practice of Bureau of Water Works and Supply, Los Angeles, Calif.; description of residual control equipment; operation results; needed improvements.

CHLORINATION, INDUSTRIAL. Chlorination of Industrial Waters, F. J. Matthews. *Power & Works Engr.*, vol. 32, no. 370, Jan. 1937, pp. 19–21. Notes on continuous and intermittent processes; features of intermittent equipment; amount of chlorine required; advantages; disadvantages; swimming baths.

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WATER WORKS ENGINEERING

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LOS ANGELES. Developing New Water Supply for Los Angeles. *Eng. News-Rec.*, vol. 118, no. 8, Feb. 25, 1937, pp. 285–290. Development of Mono Basin drainage and construction of 11-mile Mono Craters tunnel, 345 miles north of city, to increase water supply of Los Angeles by dependable flow of 150 cu ft per sec; also construction of Grant Lake at Long Valley earth-fill dams, 90 ft and 167 ft high; gas and water inflow difficulties in construction of Mono Craters tunnel.

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RATE MAKING. Present Trends Towards Simplification of Rate Case Procedure, J. Schwartz. *Am. Water Works Assn.—J.*, vol. 28, no. 11, Nov. 1936, pp. 1696–1703. Review of methods proposed for simplification of procedure in adjusting water rates; Maryland decision; Washington, D.C., plan; Minnesota proposals; Ohio and Arkansas rules; principles of rate negotiation.

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WELLS, DRILLING. Experiences in Well Construction, J. A. Carr. *Am. Water Works Assn.—J.*, vol. 28, no. 12, Dec. 1936, pp. 2005–2009. Practical suggestions and recommendations on drilling of water wells in rock, including contracting practice in such cases.

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Improved Steel Rails

"USS Brunorized Rails," a new booklet giving complete information on a new method of producing an improved steel rail for today's heavier and faster trains has been released by Carnegie-Illinois Steel Corp., subsidiary of the United States Steel Corp.

"Brunorizing," as explained in the book, is an entirely new process, developed by Carnegie-Illinois' engineers, for making better rails. By two basic improvements in rail manufacture, this new Brunorizing process achieves two corresponding inprovements in the finished rail. It largely solves two current problems—rail failures due to the fissures, fractures, and breaks; and premature replacements, due to excessive "end batter"—by increasing the resistance to conditions which cause them.

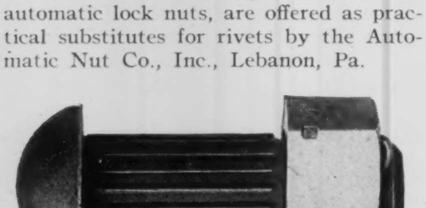
In the new booklet are included descriptions and illustrations of the first commercial equipment which makes use of this new Brunorizing process, an interesting report on widespread laboratory and service tests, accompanied by photographs, charts, and other test data, together with other pertinent material completely descriptive of the Brunorizing process and its achievements.

Chapter headings in the 24-page book cover the subjects of: —The need for a better steel rail—The rail problem—the Brunorizing process—The effects of the Brunorizing process—Comparative impact tests—Effects of controlled end-hardening—Service tests—Development of rail sections and rail metallurgy.

Copies are available from the United States Steel Corporation Subsidiaries P.O. Box 176, Pittsburgh, Pa.

Structural Rib Bolt

Bolts of carbon manganese steel, with automatic lock nuts, are offered as practical substitutes for rivets by the Automatic Nut Co., Inc., Lebanon, Pa.



The shank of the bolt carries triangular ribs which are claimed to embed themselves in the wall of the hole in the work. Bolts and nuts, with U. S. standard threads, are made in six diameters, from $^3/_8$ in. to 1 in., and in a wide range of lengths from $1^1/_6$ in. to $5^5/_6$ in. Descriptive literature will be furnished by the manufacturer.

After Ten Years

When a manufacturer puts a new product on the market he is expected to observe its performance closely—at least until he and his customers are both satisfied that the article has merit. It is a bit unusual to find a manufacturer going back after five years to determine by means of tests and inspection just how well his product has served its users. But when he goes back again after ten years and carefully surveys all instances of early use of his product and makes quantitative tests wherever possible, that is unusual.

The story is told in a very interesting booklet, "After Ten Years," which has been published by the Lone Star Cement Corporation, 342 Madison Ave., New York, N.Y. A copy will be forwarded upon request.

Transite Pressure Pipe

A report of approval on Transite Pressure Pipe has been issued by the National Board of Fire Underwriters. The report covers "Transite Class 150 pressure pipe and couplings in sizes from 4 to 24 in., inclusive, for use in underground water service where the working pressure does not exceed 150 lb per sq in."

A brief summary of conclusions drawn in the 80-page report states that: "From the conclusions drawn it will be noted that it is practical to handle and ship the pipe and couplings and install and maintain them in underground piping systems; that systems constructed of them are not subject to rapid deterioration; that the pipe and couplings are capable of withstanding all reasonable stresses to which they are likely to be subjected under ordinary service conditions; that they are reliable in service; that they are uniformly made and can be uniformly assembled."

The complete report, full information about which may be secured from Johns-Manville, 22 East 40th St., New York N.Y., was compiled after months of thorough investigation and tests of this asbestos cement product which has a twenty-year record of service in Europe and which, since its introduction by Johns-Manville in 1928, has been installed in hundreds of municipal and industrial water distribution systems in the United States and Canada.

Steel Gate Valves

Heavy wall thicknesses, deep stuffing boxes, oversize stems, streamline flow, and steel handwheels with fluted non-slip rims, are some of the latest engineering features included in the new Walworth Steel Gate Valves. They are now available for 150 lb and 300 lb steam pressures.

Folders Announced

Arc Welding—"Building a Career in Arc Welding" is the title of a 12-page booklet which tells briefly what the Lincoln Electric Co. is doing to promote practical and technical instruction in arc welding. Lincoln Electric Co., Cleveland, O.

Bolts—Thread-Locking—The principle of the Dardelet self-locking screw thread is clearly explained in a 4-page folder. The advantages, types, and uses of these bolts and nuts are also outlined. Dardelet Threadlock Corp., 55 Liberty St., New York, N.Y.

Concrete Pump—Nine sections in an interesting 50-page booklet tell the complete story of Rex Pumpcrete. These nine sections tell what Pumpcrete is; what it is doing on well known projects; where it was used; who used it; the mechanics of the Pumpcrete method; and other data on the handling of the unit, with specifications of the various sizes of Rex Pumpcrete and the accessories. Chain Belt Co., Milwaukee, Wis.

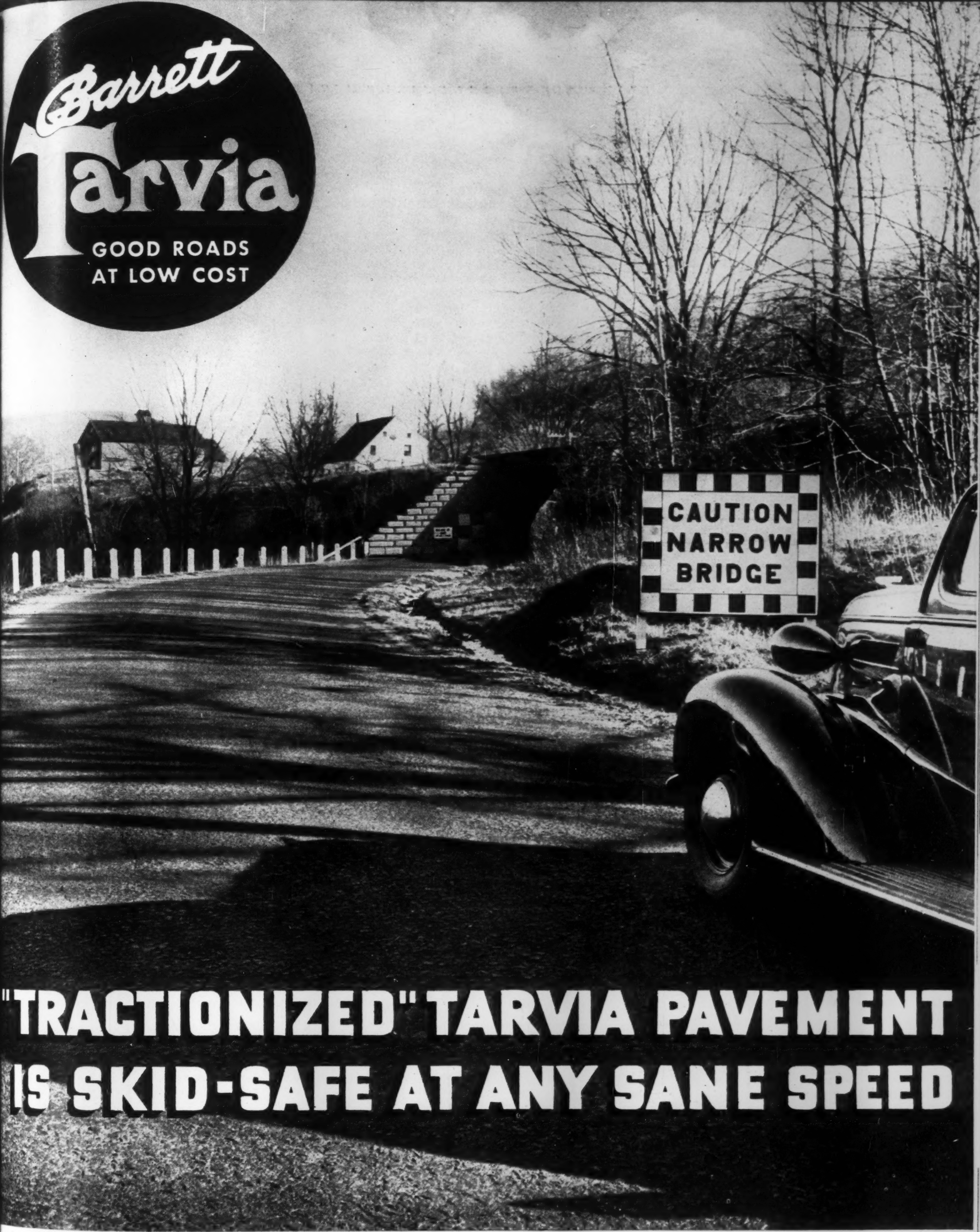
"Construction Service"—A well illustrated 12-page, $8^1/_2$ by 11 in. bulletin. Pictures and describes the pipe lines, station piping, equipment installations, water treating plants, irrigation systems, penstocks, swimming pools, refuse incinerators, sewage disposal plants, bridges, buildings, and other steel structures built by the Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa.

Cutting Tools—"Haynes Stellite J-Metal Cutting Tools," a new 52-page booklet, $8^1/_2$ by 11 in., with over 60 illustrations of tools and machining operations, contains complete, detailed information on how to obtain maximum results in machining cast iron, malleable iron, and most steels. Haynes Stellite Co., Kokomo, Ind.

Doors, Rolling and Lift—The latest Kinnear door catalog covers their steel rolling doors, fire doors, fire shutters, rolling grilles, and folding doors. Specifications, illustrations of installations, and detail drawings accompany the descriptions in the 32-page, $8^1/_2$ by 11 in. booklet. The Kinnear Manufacturing Co., Columbus, O.

Doors, Rolling and Lift—A new 12-page, $8^1/_2$ by 11 in., general catalog describes and illustrates with details and photographs of installations Cornell rolling doors, float-over, canopy, bifold, vertical lift, and turn over doors. Cornell Iron Works, 36th Ave. & 13th St., Long Island City, N.Y.

Lubrication—A series of booklets entitled "Panorama of Lubrication" is being produced by the Shell Petroleum Corp., St. Louis, Mo. These booklets answer in non-technical language with diagrammatic sketches many questions about the manufacture and application of lubricants.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MOTORS—A new bulletin (No. 1600) describes the Fairbanks-Morse line of polyphase wound-rotor or slip-ring, ball-bearing, induction motors. The high starting torque and low starting current characteristics of these wound-rotor motors make them suited to applications where high starting current is objectionable—in driving high-inertia, slow-starting loads, or where the size of motor required is large with respect to the power supply. Fairbanks, Morse & Co., Chicago, Ill.

WATER LEVEL RECORDER—Portable water level recorders, providing eight time scales are described and illustrated in a 4-page, $8^1/_2$ by 11 in. folder. Julien P. Friez & Sons, Inc., Baltimore, Md.

Electrode Designed for Fillet Welding

A NEW electrode "Fleetweld 8," which eliminates necessity of multiple pass welding in production of fillet and lap welds in many applications, and which permits production of such welds without undercutting or overlap, is announced by The Lincoln Electric Co., Cleveland, O. Fillet welds up to $^3/_8$ in. in size with one plate vertical, can be produced in one pass with the electrode. The welds show no undercutting at the vertical plate and no overlap at the horizontal plate.

The new electrode is heavily coated for welding by the shielded arc process. The welds produced are smooth and dense with notably high physical properties. The tensile strength of the weld metal as deposited is 68,000 to 72,000 lbs per sq in. Ductility is 20 to 30% elongation in 2 in. as deposited, and 30 to 36% stress relieved. Other properties including resistance to fatigue, impact, and corrosion are equal to or better than mild steel.

"Fleetweld 8" comes in 14 and 18 in. lengths. The 14 in. lengths are made in $^3/_8$ in., $^5/_{16}$ in., $^1/_4$ in., $^3/_{16}$ in., and $^5/_{32}$ in. sizes while the 18 in. lengths come only in the $^3/_8$ in., $^5/_{16}$ in., and $^1/_4$ in. sizes.

The electrode will be found of particular value by firms whose products require production of high quality fillet and lap welds at maximum speed and economy.

Concrete Joist Spacing Scales and Design Tables

A SET of 12 Concrete Joist and Rod Spacing Scales with Design Tables, just being announced by the Universal Atlas Cement Co., will prove valuable on the drafting board and designer's table of the concrete designing engineer because of the time-saving features which these scales and tables include.

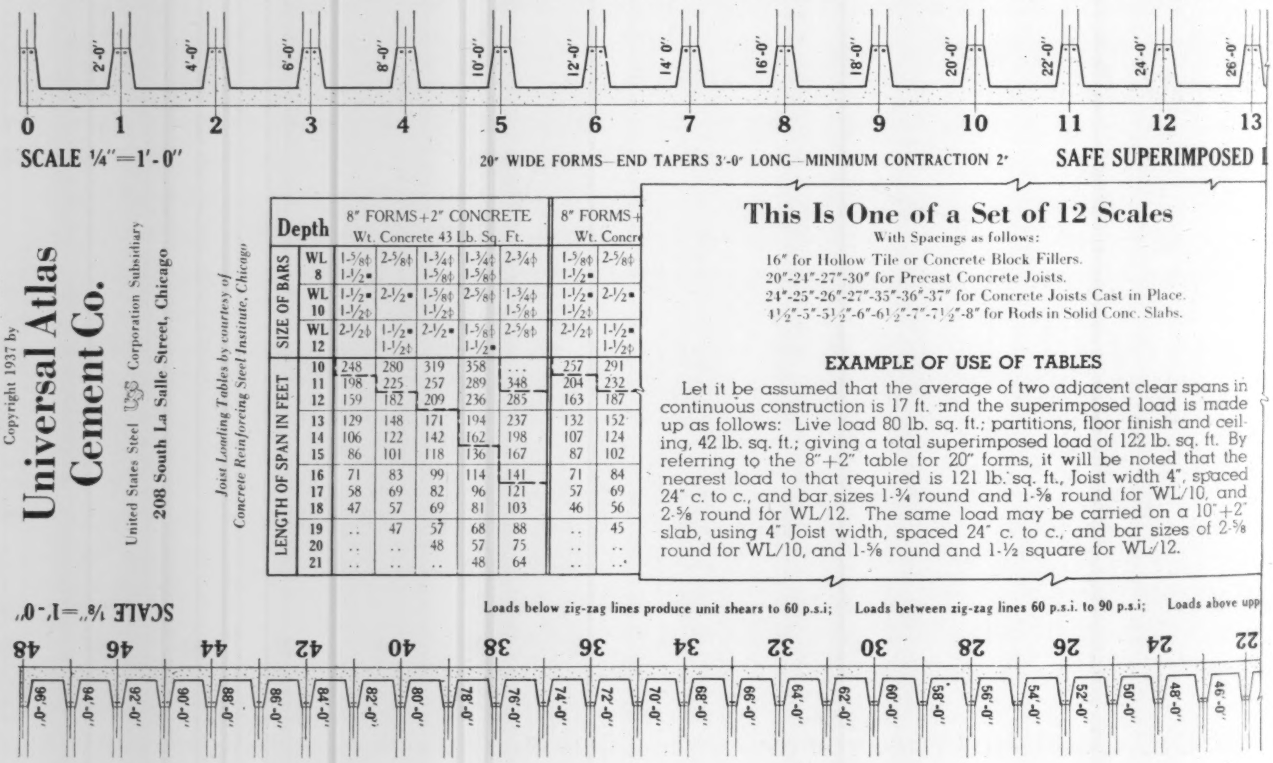
The engineer who desires to draw in the joists on a sectional drawing will find all of the standard spacings for Joists-Cast-In-Place over 20 in. and 30 in. wide steel forms. The depths of the forms vary from 6 to 14 in. and the widths of the joists from 4 to 7 in. A 16-in. spacing is included for a 4-in. wide joist with which 4, 6, and 8 in. depths of 12 in. clay tile can be used as fillers between joists. Four standard spacings are provided for use with Precast Concrete Joists.

Scales are included for Rod Spacings in Solid Concrete Slab Construction. There are many ways in which these scales for rod spacings (which vary from 4 in. to 8 in. with one-half-in. increases) may be used in the drafting room in addition to the uses for which they are primarily intended, just as the 16-in. spacing for concrete joists with clay tile fillers may be used for spacing wood joists equally as well as the concrete.

The tables on these scales show the necessary design data to make computations of depth of joists and slabs, and the bar sizes required for the sections selected. Tables are based on the latest approved code recommendations of the American Concrete Institute, viz., fs = 20,000 lb per sq in. and f'c = 3,000 lb per sq in. Joist loading tables for metal forms are by courtesy of the Concrete Reinforcing Steel Institute. Precast joist loading tables are from the "Precast Joist Concrete Floor Construction Details" of the Portland Cement Association. Clay tile filler and one-way solid concrete slab floor tables were specially prepared for this set of scales and are in accordance with the provisions of the American Concrete Institute Building Regulations for Reinforced Concrete (A.C.I.-501-36-T) for f'c = 3,000 lb per sq in.

Scales are $^1/_8$ in. and $^1/_4$ in. = 1 ft 0 in. with spacings totaling 48 ft 0 in. and 96 ft 0 in., respectively. They are printed on a tough, stiff 150 lb stock having a very durable wearing surface. Scales are along the edges of 4 in. by $14^3/_4$ in. sheets with design tables between. In general, tables apply to the scales on the same sheet. Cross references with prominently displayed scale numbers make it easy to locate any desired scale or table.

Sets of these "Concrete Joist Spacing Scales and Design Tables" will be furnished any architect, engineer, or general contractor by the Universal Atlas Cement Co., 208 So. La Salle St., Chicago, Ill., when requested on business stationery.



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Joist Loading Tables by courtesy of Concrete Reinforcing Steel Institute, Chicago

Depth		8" FORMS+2" CONCRETE Wt. Concrete 43 Lb. Sq. Ft.					8" FORMS+ Wt. Concr	
SIZE OF BARS	WL 8	1-5/8ϕ 1-1/2■	2-5/8ϕ	1-3/4ϕ 1-5/8ϕ	1-3/4ϕ 1-5/8ϕ	2-3/4ϕ	1-5/8ϕ 1-1/2■	2-5/8ϕ
	WL 10	1-1/2■ 1-1/2ϕ	2-1/2■	1-5/8ϕ 1-1/2ϕ	2-5/8ϕ	1-3/4ϕ 1-5/8ϕ	1-1/2■ 1-1/2ϕ	2-1/2■
	WL 12	2-1/2ϕ	1-1/2■ 1-1/2ϕ	2-1/2■	1-5/8ϕ 1-1/2■	2-5/8ϕ	2-1/2ϕ	1-1/2■ 1-1/2ϕ
LENGTH OF SPAN IN FEET	10	248	280	319	358	...	257	291
	11	198	225	257	289	348	204	232
	12	159	182	209	236	285	163	187
	13	129	148	171	194	237	132	152
	14	106	122	142	162	198	107	124
	15	86	101	118	136	167	87	102
	16	71	83	99	114	141	71	84
	17	58	69	82	96	121	57	69
	18	47	57	69	81	103	46	56
	19	..	47	57	68	88	..	45
	20	..	..	48	57	75	..	..
	21	..	..	..	48	64	..	..

This Is One of a Set of 12 Scales

With Spacings as follows:

16" for Hollow Tile or Concrete Block Fillers.
20"-24"-27"-30" for Precast Concrete Joists.
24"-25"-26"-27"-35"-36"-37" for Concrete Joists Cast in Place.
4½"-5"-5½"-6"-6½"-7"-7½"-8" for Rods in Solid Conc. Slabs.

EXAMPLE OF USE OF TABLES

Let it be assumed that the average of two adjacent clear spans in continuous construction is 17 ft. and the superimposed load is made up as follows: Live load 80 lb. sq. ft.; partitions, floor finish and ceiling, 42 lb. sq. ft.; giving a total superimposed load of 122 lb. sq. ft. By referring to the 8"+2" table for 20" forms, it will be noted that the nearest load to that required is 121 lb. sq. ft., Joist width 4", spaced 24" c. to c., and bar sizes 1-¾ round and 1-⅝ round for WL/10, and 2-⅝ round for WL/12. The same load may be carried on a 10"+2" slab, using 4" Joist width, spaced 24" c. to c., and bar sizes of 2-⅝ round for WL/10, and 1-⅝ round and 1-½ square for WL/12.

Loads below zig-zag lines produce unit shears to 60 p.s.i; Loads between zig-zag lines 60 p.s.i. to 90 p.s.i; Loads above upp

17
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RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1937. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Air Conditioning—Insulation. By J. R. Dalzell and J. McKinney. Chicago, American Technical Society, 1937. 301 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $2.50.

The information contained in this virtual handbook is definitely restricted to insulation. Within that field, however, the range of information is wide, covering heat, fire, sound, vibration, and vermin, and excluding only electrical insulation. There are many tables, diagrams, and practical examples of application.

American Society for Testing Materials. Index to Proceedings, Vols. 31–35 (1931–1935). Philadelphia, American Society for Testing Materials, 1937. 194 pp., 9 × 6 in., cloth, $2.25; half leather, $3.

This volume contains author and subject indexes for the "Proceedings," 1931–1935, and of the symposiums presented at regional, local, and annual meetings, and not published in the "Proceedings."

(The) Analysis of Engineering Structures. By A. J. S. Pippard and J. F. Baker. New York, Longmans, Green & Co., 1936. 554 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $9.

This is a purely theoretical treatment of structural design. On the assumption that the student is reasonably familiar with simple analytical and graphical statics, the analysis proceeds from beam stresses, elastic bodies, and other basic considerations through statically determinate and indeterminate structures to analyses of specific structural types, suspension bridges, steel framed buildings, gravity dams, and retaining walls. The final chapter takes up mechanical methods of stress analysis. An appendix contains tables of Berry functions.

Collisions in Street and Highway Transportation. By B. Mulligan. Philadelphia, Dorrance & Co., 1936. 310 pp., illus., diagrs., charts, tables, 8 × 5 in., cloth, $3.

This is a specific, detailed presentation of the causes of, and remedies for, traffic problems, particularly with respect to collisions. The author considers the various parts of the problem, from city layout through traffic control to the actual handling of individual vehicles. A systematic treatment of a complex subject.

Elementary Surveying. By William Horace Rayner. New York, D. Van Nostrand Company, Inc., 1937. 381 pp., illus., tables, diagrs., charts, 8 × 5 in., cloth, $3.

Brevity is a principal characteristic of this book, which has been designed primarily for engineering students, landscape architects, and architects. It will also serve the needs of engineers in the field, whose practice includes the usual construction and site surveys. The volume is divided into three general divisions: The use and adjustment of the instruments used in surveying; the procedure of conducting field surveys, together with the necessary methods of computing and mapping; and all necessary information about land surveying.

First Elevated Railroads in Manhattan and the Bronx of the City of New York. By W. F. Reeves. New York, New York Historical Society, 1936. 137 pp., illus., 10 × 7 in., cloth, $3.

Description of the development and progress of the early elevated railroads in Manhattan and the Bronx, including the various schemes proposed from 1825 up to the first actual construction, in 1867, of an elevated line utilizing cable traction. The bulk of the information concerns construction activities. There are sixty-four illustrations from original photographs and prints in the author's private collection.

Great Britain, Department of Scientific and Industrial Research. Report for 1935–1936. London, His Majesty's Stationery Office, 1937 (obtainable from British Library of Information, 270 Madison Ave., New York). 195 pp., tables, 10 × 6 in., paper, 95 cents.

A comprehensive summary of the work carried on during the year in the various establishments of the Departments is given in this volume. Each report includes a list of articles published as a result of the investigations. A summary of the work of other British research institutions is also presented, so that the book forms a convenient review of all scientific and industrial research in Great Britain. Useful appendixes give the membership of the Department committees, the addresses of its establishments, and the addresses and directors of other research institutions, of publications by the recipients of grants for research, and of the departmental publications.

International Association for Testing Materials, International Congress, London, April 19–24, 1937. Advance Proofs of Papers, Groups A–D. London (S.W.1, 28 Victoria St.), International Association for Testing Materials, 1937. Group A, 174 pp.; Group B, 159 pp., Group C, 106 pp.; Group D, 71 pp. Illus., diagrs., charts, tables, 11 × 7 in., paper, apply.

These pamphlets contain advance proofs of the papers submitted at the London congress of the Association in April 1937. The subjects discussed include the effect of temperature upon the behavior of metals; the progress of metallography; light metals and their alloys; the workability and wear of metals; cement and reinforced concrete; natural stone; ceramic materials; textiles; wood cellulose; timber preservation; the aging of organic materials; colors and varnishes; the relation between the results of laboratory tests and behavior in use; the bearing of recent advances in physics and chemistry on the knowledge of materials; and the properties of materials for the thermal and acoustic insulation of buildings.

Men of Mathematics. By E. T. Bell. New York, Simon and Schuster, 1937. 592 pp., illus., diagrs., charts, tables, 10 × 6 in., cloth $5.

Biographical and critical information about the important men in the mathematical field, from the Greeks to the present time, who have contrived, explored, or expanded the concepts that are the basis for the modern physical sciences. Relatively simple examples of their work are used to illustrate the direction and scope of their researches.

Municipal and Rural Sanitation, 2 ed. By V. M. Ehlers and E. W. Steel. New York and London, McGraw-Hill Book Co., 1937. 477 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $4.

A revised edition of a standard textbook on sanitation. It is intended to contain the minimum of information necessary for a sanitary engineer. Among the topics covered are methods of disease communication, sewage and refuse disposal, water treatment, vermin control, food sanitation, plumbing and ventilation, disinfection, and a chapter on public health organizations.

Municipal Year Book. 1937. Edited by C. E. Ridley and O. F. Nolting. Chicago, International City Managers' Association, 1937. 599 pp., diagrs., charts, maps, tables, 10 × 7 in., cloth, $5.

Part I of this enlarged 1937 issue contains articles on developments in various fields of municipal administration. Part II covers trends in urban population, and gives statistics on cities with a population of over 10,000. Part III, which is on municipal personnel, lists educational institutions giving courses in public administration and professional organizations in the field, and includes a directory of city officials in all cities of over 10,000. Part IV has financial statistics of cities over 100,000 population and a section on "Financing Relief and Recovery." Part V lists sources of information, organizations, standards, ordinances, books, and periodicals, for the assistance of municipal officials.

New York, the Canal State, the Story of America's Great Water Route from the Lakes to the Sea, Builder of East and West. By F. P. Kimball. Albany, Argus Press, 1937. 105 pp., illus., maps, 9 × 6 in., paper, $1.75.

A historical description of the Erie Canal from its inception to the present day, demonstrating its influence on the state of New York, the port of New York, and the general development of transportation between the Great Lakes and the Atlantic seaboard. The author discusses, from an adverse viewpoint, the probable effect of the proposed St. Lawrence "seaway" on the Erie Canal, the railroads, and the American seaports.

Proceedings of the Sixteenth Annual Meeting of the Highway Research Board. Edited by Roy W. Crum. Washington, D.C., Highway Research Board, 1936. 390 pp., illus., tables, diagrs., charts, 10 × 7 in., cloth, $2.25.

This volume includes the papers and reports presented at the sixteenth annual meeting of the Highway Research Board, held in Washington, D.C., November 18–20, 1936. Among the subjects considered in the volume are finance; design; materials and construction; maintenance; traffic and safety; soils investigation; and road soil investigation.

Reinforced Concrete Construction, 4 ed. Vol. 1, Fundamental Principles. By G. A. Hool; revised by H. E. Pulver. New York and London, McGraw-Hill Book Co., 1937. 454 pp., diagrs., charts, tables, 9 × 6 in., cloth, $4.

This fourth edition of Volume I of Hool's three-volume work has been in great part rewritten to cover modern practice and to conform with the American Concrete Institute 1936 "Building Regulations for Reinforced Concrete." Part I covers materials and Part II the theory and design of slabs, beams, and columns. Many useful tables and diagrams are given in the last chapter, and an appendix treats "Shear and Moment Considerations in Continuous Beams."

(The) Supervision of Construction Operations. By W. W. Beach. New York and London, Charles Scribner's Sons, 1937. 488 pp., illus., diagrs., charts, tables, 10 × 6 in., leather, $6.

A detailed treatment of the subject of construction supervision, covering the many phases of such work. Beginning with ethical considerations and record keeping, the text takes up the actual supervision of the work from foundation to plumbing, ending with discussions of completion and acceptance problems and cost-plus construction work. Illustrations of documentary forms appear in appendixes, as does also a long "List of Trade Associations in the Construction Supply Industries."

Theory of Modern Steel Structures, Vol. 2. Statically Indeterminate Structures and Space Frames. By L. E. Grinter. New York, Macmillan Co., 1937. 285 pp. illus., diagrs., charts, tables, 9 × 6 in., leather, $4.50.

A discussion of what constitutes indeterminacy begins this second volume. Then follow chapters on deflections of structures; classical methods of analysis of indeterminate structures; continuous, movable, and long-span bridges; continuous frames; and arches and closed rings. The final chapter considers the analysis of continuous frames by balancing angle changes. The book is written in a simple textbook style to cover basic principles.

VDI—Jahrbuch 1937. Die Chronik der Technik. Edited by A. Leitner. Berlin, VDI—Verlag, 1937. 228 pp., 8 × 6 in., paper, 3.50 rm.

The "yearbook" provides a concise annual review of outstanding developments in the engineering field, enabling the user to survey rapidly the principal achievements in all branches. Some eighty brief surveys are included, with references to over 7,000 sources of more detailed information. A lengthy index is included.

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BRIDGES

CONCRETE ARCH, MOROCCO. Road Bridge in French Morocco. *Concrete & Constr. Eng.*, vol. 31, no. 11, Nov. 1936, pp. 591–594. Design and construction of highway bridge, at Sidi-Aiessa, French Morocco, of bowstring type with 220-ft span and rise of 36 ft 7 in.; inclined hangers were adopted; loading test.

CONCRETE ARCH, TURKEY. Deux ponts en béton armé sur l'Euphrate, en Turquie, C. A. G. Scheel. *Technique des Travaux*, vol. 12, no. 9, Sept. 1936, pp. 485–492. Construction of two concrete-arch railroad bridges over Upper Euphrates River in Turkey, by Freyssinet prestressing method; bridge near Malatya has total length of 351 m; maximum span 50 m; Ismet-Pasha bridge consists of single fixed span 108 m long and 24 m in rise.

CONSTRUCTION ACCIDENTS. Failure of Moving Scaffold on Golden Gate Bridge Reviewed. *Eng. News-Rec.*, vol. 118, no. 10, Mar. 11, 1937, pp. 377–379. Investigations leading to surmise that fall of platform, with ten fatalities, as workers stripped roadway forms, may have had initial cause in failure to use safety bolt, although several other causes are possible; new safety net being installed; scaffold design.

DEVELOPMENTS. Roads, Bridges, and Tunnels in 1936. *Engineer*, vol. 163, no. 4225, Jan. 1, 1937, pp. 4–8, supp. plates. Illustrated review of outstanding developments in various countries.

FLOORS. Composite Timber-Concrete Decks for Highway Bridges, W. D. Keeney. *Roads & Streets*, vol. 80, no. 3, Mar. 1937, pp. 35–36. Advantages determined by tests by Oregon State Highway Commission at Oregon State College of homogeneous combined timber and concrete stress-bearing members.

RAILROAD. Report of Special Committee on Economics of Bridges and Trestles. *Am. Ry. Eng. Assn.-Bul.*, vol. 38, no. 392, Dec. 1936, pp. 433–436. Progress report.

STEEL, WELDING. Canada's Largest All-Welded Bridge, A. F. Davis. *Welding Engr.*, vol. 22, no. 3, Mar. 1937, pp. 34–35. Description of one of first bridges to be erected entirely by welding recently completed across St. Anne River at La Perade, Quebec, on King's Highway No. 2—main traffic artery between Montreal and Quebec; it is 642 ft long with 24-ft roadway and 5-ft sidewalk on each side; consists of six continuous deck-girder spans, each 107 ft long; illustrations.

STEEL ARCH, DENMARK. Le pont du Storstroem (Danemark), C. A. G. Scheel. *Technique des Travaux*, vol. 12, no. 7, July 1936, pp. 381–386. Design and construction of Storstroem steel arch and plate girder bridge connecting islands of Falster and Seeland, Denmark, having total length of 3,211 m; maximum span 136.4 m; construction of concrete piers and erection of steel spans; total cost 38,000,000 crowns.

STEEL ARCH, NEW YORK CITY. Henry Hudson Bridge, R. G. Skerrett. *Compressed Air Mag.*, vol. 42, no. 1, Jan. 1937, pp. 5226–5228. Design features of Henry Hudson Bridge over Harlem River for four lanes of highway traffic 2,000 ft long with 800-ft steel arch; two steel girder viaducts, each 300 ft long; and two concrete frame and wall approaches.

STEEL TRUSS, ROUSES POINT, N.Y. Rouses Point Bridge Across Lake Champlain, Between Rouses Point, New York, and Alburg, Vermont, C. A. Farwell and H. J. Williams. *Boston Soc. Civ. Engrs. J.*, vol. 24, no. 1, Jan. 1937, pp. 1–27. Two papers on design and construction of highway bridge, consisting of 12 fixed semi-through steel-truss spans, each about 122 ft long, and one through steel-truss span, 320 ft long.

STEEL TRUSS, TESTING. Tests of Callender-Hamilton Unit-Construction Bridge. *Engineering*, vol. 143, no. 3704, Jan. 8, 1937, pp. 36–37. Tests carried out at Royal Engineer Experimental Bridging Establishment, on 140-ft double-truss bridge made on Callender-Hamilton system, consisting of special form of Warren truss, chords and diagonals of which are composed of 6 by 6 by 3/8-in. angles in 10-ft. lengths.

VIADUCTS. Southern Pacific Reinforces Ten Steel Viaducts. *Ry. Age*, vol. 102, no. 10, Mar. 6, 1937, pp. 392–394. Method used to reinforce ten viaducts, totaling 6,276 ft in length, between Surf and Santa Barbara, Calif.; all of same design with 30-ft tower spans and 60-ft span between towers; height from 60 to 95 ft maximum.

BUILDINGS

CODES, UNITED STATES. Building Codes in United States, R. Fleming. *Engineering*, vol. 142, no. 3702, Dec. 25, 1936, pp. 688–690. Discussion of codes relating to human occupancy, industrial or commercial occupancy, roof loads, recommendations of U. S. Department of Commerce Building Code Committee, and code recommended by National Board of Fire Underwriters, etc.

EARTHQUAKE RESISTANCE. Repairing Earthquake Damage. J. E. Byers. *Eng. News-Rec.*, vol. 118, no. 10, Mar. 11, 1937, pp. 362–366. Practice of Los Angeles Board of Education in classification of buildings according to seismic resistance; rehabilitation costs; rehabilitation schemes; anchoring floors and roofs.

CITY AND REGIONAL PLANNING

ANCIENT. Grundsaetzliches zur Gesundung der Wohnverhaeltnisse in den mittelalterlichen Altstaedten, E. Labes. *Gesundheits-Ingenieur*, vol. 59, no. 34, Aug. 22, 1936, pp. 508–510. Suggestions on methods of modernization and sanitation of residential districts of ancient cities.

GERMANY. German Regional Planning, B. Wehner. *Planners' J.*, vol. 3, no. 1, Jan.-Feb., 1937, pp. 9–12. Urbanization in Germany; planning in Ruhr territory; beginning of national planning; organization of National Planning Board; planning and science; housing as part of governmental planning; financing of housing; debt limitations.

GREAT BRITAIN. Town and Country Planning Under the Act, G. L. Pepler. Working of Advisory Panels System, G. H. Jack. *Roy. Inst. Brit. Architects—J.*, vol. 44, 3d series, no. 10, Mar. 20, 1937, pp. 477–492 (discussion), 492–499. Symposium of two papers read before Royal Institute of British Architects.

LAWS AND LEGISLATION. Swedish Planning Laws, R. C. Weinberg. *Planners' J.*, vol. 3, no. 1, Jan.-Feb., 1937, pp. 13–20. Digest of Federal Law for City Planning and of Building Law of City of Stockholm; subdivision of blocks into lots; control of new building development; redemption of land within planned territory; regulations applying to unincorporated urban centers.

MOSCOW. Une planification sans précédent: La reconstruction de Moscou, A. Lurcat. *Technique des Travaux*, vol. 12, no. 9, Sept. 1936, pp. 477–484. Outline of general scheme for replanning city of Moscow, including new water supply, district heating system, subway system, new bridges, new school buildings, parks, and huge apartment houses.

CONCRETE

ADMIXTURES. Practical Application of Catalysis and Dispersion to Cement and Concrete, H. L. Kennedy. *Boston Soc. Civ. Engrs.—J.*, vol. 24, no. 1, Jan. 1937, pp. 28–45. Properties of so-called TDA catalyzer developed by Dewey & Almy Chemical Co., consisting of mixture of triethanolamine and soluble calcium salts of modified lignin sulphonic acid; theory of setting and hardening of cement paste; comparison of bleeding characteristics of untreated and treated cements; permeability; laitance; practical significance of non-homogeneity; design of columns and flexural members.

CEMENT, HIGH TEST. Institution Research Committee. Joint Sub-Committee on Special Cements, F. M. Lea. *Instn. Civ. Engrs.—J.*, no. 4, Feb. 1937, pp. 217–229. Summary of present position with regard to cements, in which some modifications of properties of portland cement are deliberately introduced to provide user with material more suited to certain requirements than normal or rapid hardening products of present day; special cements for mass concrete structures and their specification.

CONSTRUCTION, COSTS. Design and Cost of Shuttering, C. E. Reynolds. *Concrete & Constr. Eng.*, vol. 31, no. 8, Aug. 1936, pp. 449–460. Selection of materials for concrete forms; loads and pressures; forms for floor panel and columns; costs.

CONSTRUCTION, FORMS. Shrinkage Stresses in Sliding Shutter Work, G. P. Manning. *Concrete & Constr. Eng.*, vol. 31, no. 7, July 1936, pp. 365–366. Analysis of cracking tendency in walls of silos and similar structures built with sliding forms; suggestions for preventing such cracking.

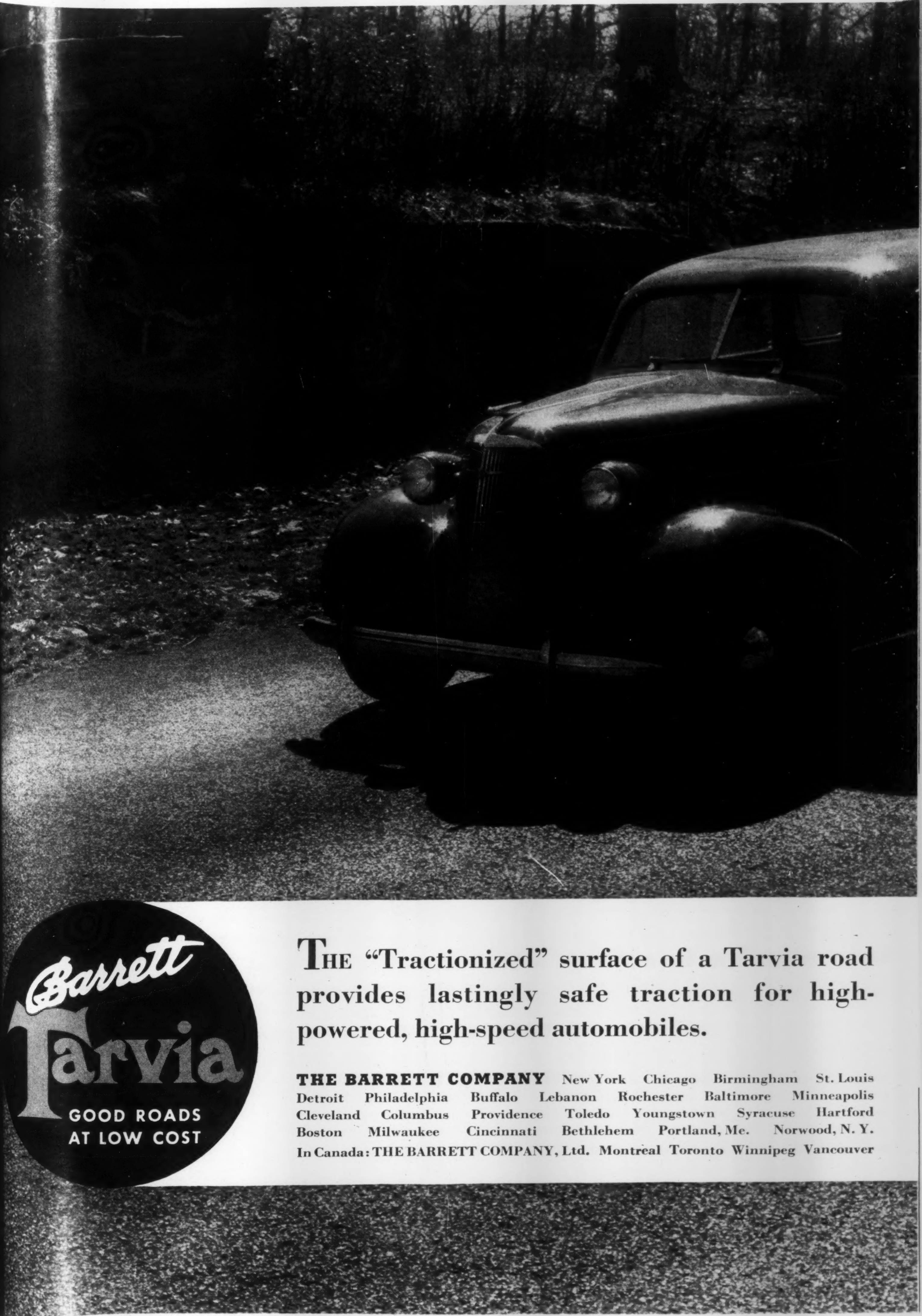
CONSTRUCTION, VIBRATING. Vibrated Concrete Practice in Europe, J. M. Antill. *Commonwealth Engr.*, vol. 23, no. 11, June 1, 1936, pp. 331–339. Account of methods and apparatus; fundamental principles; technique of vibration; properties of vibrated concrete; vibrating unit; influence of vibration on construction methods.

DEFECTS. Surface Blemishes on Concrete, F. W. Freise. *Concrete & Constr. Eng.*, vol. 31, no. 8, Aug. 1936, pp. 415–420. Observations on surface blemishes of concrete structures in South America, illustrating injurious effect of certain vegetable and animal organisms.

DESIGN. Stand der Betonbauweise, H. Casper. *VDI Zeit*, vol. 81, no. 6, Feb. 6, 1937, pp.149–153. Present status of concrete for design and construction; review of discussion at Second International Congress on Bridges and Structures; notes on roads; safety of reinforced concrete construction from viewpoint of designer; recent views on design and construction of reinforced concrete buildings and bridges; concrete in hydraulic engineering

LAKES, GROUTING. Sealing of Hanna Lake, H. I. Pocock *Roy. Engrs. J.*, vol. 51, Mar. 1937, pp. 27–42, 5 supp. sheets. Use of cement guns for sealing leaky area of 100,000 sq ft in bank of Hanna Lake, Baluchistan, whose waters are used for irrigation; organization of working crews and gunite operations.

LIGHT WEIGHT. Experience with Light Aggregate in Concrete Construction, R. S. McLean. *Eng. News-Rec.*, vol. 118, no. 13, Apr. 1, 1937, pp. 484–485. Experience with exclusive use of five types of light-weight aggregates in 2-story Commerce Building recently constructed on new campus of Junior College in Fullerton, Calif.; concrete weighed only 115 lb per cu ft; absorption rate of coarse light-weight aggregate; strength and slump tests.



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Reinforcement, Welding. Welded Bars for Reinforced Concrete Structures, O. Bondy. *Concrete & Constr. Eng.*, vol. 31, no. 9, Sept. 1936, pp. 487–492. Review of recently developed methods of welding of reinforcing bars, with special reference to German practice.

Specifications. New Austrian Regulations for Reinforced Concrete. *Concrete & Constr. Eng.*, vol. 31, no. 12, Dec. 1936, pp. 653–656. Abstract of revised Austrian specifications for reinforced concrete; permissible stresses in columns; bending and composite stresses; measurement of consistency; methods of making tests.

CONSTRUCTION INDUSTRY

Building Codes, Great Britain. Regulations for Reinforced Concrete. *Concrete & Constr. Eng.*, vol. 31, no. 9, Sept. 1936, pp. 504–516. Excerpts from building by-laws proposed to London County Council in pursuance of London Building Act, 1935, referring to reinforced-concrete construction; materials of construction; foundations and sites of buildings and excavations adjacent thereto; walls and piers; use of reinforced concrete.

Costs. Current Construction Unit Prices. *Eng. News-Rec.*, vol. 118, no. 11, Mar. 18, 1937, pp. 429–430. Unit costs bid on construction of 5 miles of 40- to 60-in. steel pipe line near San Francisco, Calif.; concrete reservoir, San Francisco; open gate controlled dam No. 17 in Mississippi River; and 22.5 miles of 20-ft reinforced concrete pavement in Indiana.

DAMS

Concrete Arch, Wyoming. Seminoe Dam. I—Site Exploration and Design Studies, K. B. Keener. II—Construction Plant for Seminoe Dam, V. L. Peugh. *Eng. News-Rec.*, vol. 118, no. 11, Mar. 18, 1937, pp. 395–400. Design and construction of concrete arch dam on North Platte River in Wyoming; 270-ft. maximum height; 560-ft crest length.

Construction. Construction of Large Modern Water Dams, A. Coyne. *Surveyor*, vol. 91, no. 2351, Feb. 12, 1937, pp. 271–272. Methods used in France. Before joint meeting of Instn. Structural Engr.—British Section of Societé des Ingenieurs Civils de France and Instn. Civ. Engrs.

Design. Modern Dams. *Surveyor*, vol. 91, no. 2348, Jan. 22, 1937, pp. 93–94. Review of recent papers and articles on dam design published in the United States, by T. T. Knappen, R. A. Sutherland, G. E. Barnes, and J. G. Jobes.

Earth, Soil Mechanics. Practical Soil Mechanics for Small Dams, D. Doggett. *Eng. News-Rec.*, vol. 118, no. 11, Mar. 18, 1937, pp. 409–412. Advantageous use of grain size analysis; Proctor density test; compaction with sheepsfoot rollers; use of California section in building some 30 small earth dams by Indiana Department of Conservation.

Rock Fill, China. Flexible Face for Rock-Fill Dam, H. J. F. Gourley. *Water Works Eng.*, vol. 90, no. 5, Mar. 3, 1937, pp. 270–272. Hand-placed rock-fill dam on Hong Kong River in China, 625 ft high from datum and 700 ft long, is composite structure consisting of five portions, cut-off wall, diaphragm of concrete slabs, thrust block, rock fill, and sand wedge.

Spillways Construction. Spillway at Fort Peck. *Excavating Engr.*, vol. 31, no. 2, Feb. 1937, pp. 90–95, and 124. Design and construction of Fort Peck gate-controlled open spillway with capacity of 255,000 cu ft per sec; 9,700 ft long; involving 14,000,000 cu yd of excavation.

FLOOD CONTROL

China. Hydraulic and Road Questions in China, O. J. Todd and S. Eliassen. *Assn. Chinese & Am. Engrs.—J.*, vol. 17, no. 6, Nov.-Dec. 1936, pp. 333–351, (discussion) 352–357. Review of report by Committee of Experts of League of Nations; Wei Pei project; Lo Ho project; Saratsi project; Kuan Ting reservoir on Young Ting Ho (Hopei); Yellow River; Yangtze River. (In English.)

Discharge. River Flood Measurement from Height Records, R. W. H. Hawken. *Instn. Engrs. Australia—J.*, vol. 8, no. 8, Aug. 1936, pp. 281–285. Mathematical analysis leading to method of flood measurement by using stream volume itself as measuring unit; empirical and practical modifications; repetitive curves; formula and procedure for deducing velocities and flow from observed slopes of water surface.

Mexico. Desert Foods in Sonayta Valley, R. L. Ives. *Am. J. Science*, vol. 32, no. 191, Nov. 1936, pp. 349–360. Major types are sheet floods, stream floods, and playa floods; characteristics of primary and secondary floods.

Ohio Valley. Rehabilitation of Ohio Valley, H. W. Richardson. *Eng. News-Rec.*, vol. 118, no. 10, Mar. 11, 1937, pp. 380–383. Rehabilitation of territory damaged by floods of January 1937; flood-stricken communities are coming back in amazingly quick time as debris is cleared away, damaged property is repaired, and essential services are restored; typical flood losses in Ohio Valley.

Public Works, Damage. Hell in High Water, E. J. Tangerman. *Power*, vol. 81, no. 4, Apr. 1937, pp. 182–186. Account of battle between power men and deluge at Louisville and Cincinnati; experiences with pumping plants, steam and hydroelectric plants, etc.

Science. Scientific Aspects of Flood Control. *Am. Assn. for Advancement of Science—Publ.* (supp. to *Science*), vol. 84, no. 3, Oct. 1936, 47 pp., 50 cents. Symposium sponsored by Ecological Society of America and American Assn. for Advancement of Science, Rochester, N.Y., June 18, 1936; Introduction, W. S. Cooper; Forests and Flood Control, F. A. Silcox; Agricultural Land Use and Flood Control, W. C. Lowdermilk; On Relations of Engineering Science to Flood Control, M. L. Cooke.

United States. Control of Great Floods, A. E. Morgan. *Eng. News-Rec.*, vol. 118, no. 11, Mar. 18, 1937, pp. 401–403. Authoritative review of flood-control problem in United States, outlining general conditions of developing and administering integrated river-control plan; radical re-examination of existing data and solutions required; solution of flood problem by reservoirs, levees, watersheds, and soils control.

FOUNDATIONS

Caissons, Steel. Unusual Type of Caisson Devised to Realign and Strengthen Bridge Pier, H. W. Young. *Steel*, vol. 100, no. 11, Mar. 15, 1937, p. 76. Method used in constructing caisson of interlocking steel sheet piling, 110 ft in diameter, for straightening and strengthening pier of highway bridge over Columbia River, below Grand Coulee Dam, Washington.

Design. Soil-Line Method of Raft Design—I, II, III, and IV, A. L. L. Baker. *Concrete & Constr. Eng.*, vol. 31, no. 8, 9, 10, and 12, August, 1936, pp. 421–432; September, pp. 493–497; October 569–573; and December, pp. 677–690. August: Design of raft foundations; forces and bending moments acting on beams. September: Soil line; beam line. October: Modulus of elasticity of soil; soil-line limits of particular bearing area. December: Pressure tests; boreholes, and inspection of site; formula for moment reduction factor; determination of best flexibility for raft beam. (To be continued.)

Earth Pressure. Lateral Earth Pressure Due to Concentrated Loads, D. H. Lee. *Concrete & Constr. Eng.*, vol. 31, no. 12, Dec. 1936, pp. 642–646. Theoretical discussion of results of University of Iowa tests, made by M. G. Spangler, based on Boussinesq formula for lateral pressure exerted on back of retaining walls and bridge abutments by concentrated loads at, or near, surface of filling.

Subsidence. Ueber die Messung von Setzungen eines Bauwerkes, H. Loeschner. *Zeit fuer Instrumentenkunde*, vol. 57, no. 1, Jan. 1937, pp. 1–14. Description of author's original micrometric method of precise measurement of settlement of buildings and structures; performance; and precision of method.

Wood Preservation, Railroads. Report of Committee XVII—Wood Preservation. *Am. Ry. Eng. Assn.—Bul.*, vol. 38, no. 391, Nov. 1936, pp. 309–353, 1 supp. plate. Service test records for treated ties; piling used for marine construction; destruction by termites and possible ways of prevention; outline of complete field of work of Committee.

HYDRAULIC ENGINEERING

Models. Similarity and Its Application to Problems of Fluid Motion, M. A. Hogan and E. F. Gibbs. *Concrete & Constr. Eng.*, vol. 31, no. 7, July 1936, pp. 385–403. Theoretical mathematical discussion of principle of similitude and of hydraulic models; principles governing relative behaviors of models and full-size hydraulic structures, such as weirs, sluices, intakes, siphon spillways, bridge piers, etc.; dimensional analysis; dynamical similarity; experiments with models.

HYDROELECTRIC POWER PLANTS

Great Britain. Second-Stage Development of Lochaber Water-Power Scheme, A. H. Naylor. *Instn. Civ. Engrs.—J.*, no. 4, Feb. 1937, pp. 3–48, (discussion) 49–88, 3 supp. sheets. Report on design and construction of second-stage structures, including Laggan concrete gravity dam, about 175 ft maximum height; Treig concrete core earth dam, 65 ft maximum height; Treig concrete gravity spillway dam, about 170 ft maximum height; 15-mile tunnel; penstocks, etc.; study of internal temperature and formation of cracks in Laggan Dam; deflection of Laggan Dam.

HYDROLOGY AND METEOROLOGY

Rain and Rainfall, Great Britain. Assessing Loss and Rainfall Over Vyrnwy Catchment Area, D. Lloyd. *Water & Water Eng.*, vol. 38, no. 470, Nov. 1936, pp. 580–585. Intensive study of temperature, rainfall, and evaporation of watershed, having area of 23,000 acres; average loss over areas; computing annual rainfall over area. Bibliography.

Reservoirs, Evaporation. Evaporation in Water Reservoirs Overgrown with Water Plants, A. M. Arenstein. *Académie des Sciences de l'urss*—C. R., vol. 14, no. 1, 1937, pp. 35–38. Results of experimental study by Biological Laboratory of Institute of Hydraulic Research in Moscow, leading to conclusion that floating plants decrease evaporation from reservoirs; effect of meteorological factors on evaporation from open water surfaces. Bibliography. (In English.)

INLAND WATERWAYS

Canals, Inlets. Der Hochwassereinlass be Ruehen (Mittellandkana 1), Dettmers und Woeltinger. *Bautechnik*, vol. 14, no. 41, Sept. 18, 1936, pp. 599–600. Construction of inlet structure in Mittelland Canal at Ruehen, Germany, for relief of flood conditions of Droemling marshlands, occupying area of about 22 sq km.

IRRIGATION

Australia. Irrigation in Australia, A. D. Lewis. *Water & Water Eng.*, vol. 38, no. 470, Nov. 1936, pp. 585–591. Report of tour made in 1935 by Director of Irrigation, Union of South Africa; Murray River scheme and Hume Dam; Maffra-Sale scheme; Wimmera-Mallee domestic and stock water scheme; system of "ironclad," or "100 per cent" catchments evolved in Victoria.

Canals. Water to Make the Desert Bloom, J. C. Coyle. *Compressed Air Mag.*, vol. 42, no. 1, Jan. 1937, pp. 5218–5225. Construction operations on All-American Canal, 80 miles long, in Imperial Valley, from Imperial Dam on Colorado River in Southern California.

Canals, Costs. Earthwork and Structures, Contra Costa Canal Station 2+00 to Station 208+50. *U. S. Bur. Reclamation—Specifications*, no. 719, 1937, 35 pp., 6 supp. plates. Schedule, specifications, and drawings for construction of 20,650 ft of irrigation canal, about 24-ft bottom width and about 20-ft average depth, involving total excavation of 640,000 cu yd, for Contra Costa division, Central Valley project, near Oakley, Calif.

China. Development of Irrigation Works in Province of Shensi, H. Li. *Assn. Chinese & Am. Engrs.—J.*, vol. 17, no. 6, Nov.-Dec. 1936, pp. 309–327, 5 supp. sheets. Examination of possibility of irrigation development in Shensi; King Hui Canal system; Lo Hui Canal system; Wei Hui Canal system; Mei Hui Canal system. (In English.)

Pumping Plants, Arizona. Drought Hazard Overcome in Arizona Irrigation Project with Pumps, R. Hornberger. *Western City*, vol. 12, no. 8, Aug. 1936, pp. 15–16, and 45–46. Installation of 80 deep well turbine pump units on San Carlos project of U. S. Indian Irrigation Service, near Coolidge, Ariz.; purchase of pumps; pump specifications; efficiency evaluation; shop and field tests; pump houses and controls; installation results.

MATERIALS TESTING

Soils, Testing. Kjellman Soil-Testing Machine, K. Terzaghi. *Engineering*, vol. 143, no. 3703, Jan. 1, 1937, pp. 10–11. Description of machine employed in Soil Mechanics Laboratory of Harvard University; main characteristic is that soil specimen of cubical form can be subjected to loading on three axes simultaneously.

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Canary Islands. Oil and Coal Bunkering Extensions in Canary Islands. *Engineering*, vol. 143, nos. 3705 and 3707, Jan. 15, 1937, pp. 55–58 and 68, and Jan. 29, pp. 110–114, supp. plates. Illustrated description of developments in Canary Islands by Cory Brothers and Company, London.

Developments. Harbors and Waterways in 1936. *Engineer*, vol. 163, nos. 4226 and 4227, Jan. 8, 1937, pp. 34–35, and Jan. 15, pp. 67–69. Review of developments in United Kingdom and Irish Free State, European ports and waterways, Africa, the East, and America.

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Shore Protection, North Sea. Coast Protection on North Sea Coasts of Holland, France, Belgium, and Germany, J. H. van der Burgt. *Roy. Engrs. J.*, vol. 51, Mar. 1937, pp. 1–13, 7 supp. sheets; appendix of maps in separate supp. pamphlet of same issue. History and description of groins and other shore protection works of North Sea; organization for construction and maintenance of such works on coasts of Holland; maintenance costs. Bibliography. Translated from article in *Ingenieur*, No. 50, 1933.

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Accident Prevention, Speed. Speed versus Safety for Highway Traffic, H. Tucker. *Roads & Streets*, vol. 80, no. 3, Mar. 1937, pp. 88, 90, and 92. Influence of speed on highway accident; highway design for travel at high speeds; methods of controlling speed.

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Construction. Pavement Design and Construction in Minneapolis, E. F. Campbell. *Eng. News-Rec.*, vol. 118, no. 13, Apr. 1, 1937, pp. 471–475. Design and construction of three types of pavements: asphaltic concrete, cement concrete, and brick; technique of present construction and maintenance operations; expansion and contraction joints at intersections; weight and proportions of asphalt mixes used in Minneapolis paving; comparative maintenance costs.

Stabilization, Experiments. Stabilizing Soil with Portland Cement, W. H. Mills, Jr. *Roads & Streets*, vol. 80, no. 3, Mar. 1937, pp. 29–34. Results of experiments conducted since 1932 both in field and in laboratory by South Carolina Highway Department to determine practicability of soil-cement mixtures for construction of low-cost roads.

SEWERAGE AND SEWAGE DISPOSAL

Chemical Process. Chemical Methods of Treating Sewage. *Surveyor*, vol. 91, no. 2353, Feb. 26, 1937, pp. 343–344, (discussion) 344–347. Symposium on British, American, and German practice by J. H. Garner, H. H. Hendon, and K. Imhoff. Before Instn. Chem. Engrs.

Chemical Process, Methods. Chemicals in Sewage Treatment. *Mun. Sanitation*, vol. 8, no. 3, Mar. 1937, pp. 193–194. Practical discussion by plant superintendents regarding chemicals used for sludge conditioning and chemical precipitation, dosage, methods of handling and application, and results obtained.

Costs. Disintegration of Solid Matter in Sewage, H. R. Lupton. *Surveyor*, vol. 91, no. 2347, Jan. 15, 1937, p. 69, and (discussion) pp. 69–72. Advantages resulting from disintegration and costs. Before Instn. Sanitary Engrs.

Filters, Trickling. Rapid Filtration of Sewage, F. W. Mohlman. *Surveyor*, vol. 91, no. 2346, Jan. 8, 1937, p. 35. One year's operation of experimental high-rate trickling filter at West Side treatment works, Chicago.

India. Water Supply and Sewage Disposal in India, F. C. Temple. *Surveyor*, vol. 91, no. 2352, Feb. 19, 1937, pp. 309–310. Review of 30 years of progress; present-day practices in waterworks engineering, prevention of waste, and sewage disposal. Before Inst. Sanitary Engrs.

Plants, Bloomington, Ind. New Sewage-Treatment Plant Built to Be Attractive, C. B. Carpenter. *Am. City*, vol. 52, no. 3, Mar. 1937, pp. 60–62. Trickling filter; separate sludge digestion plant designed for population of 30,000; design, equipment, and cost.

Plants, Greenbelt, Md. Model Waste Disposal for Model Town, F. Schmitt. *Mun. Sanitation*, vol. 8, no. 3, Mar. 1937, pp. 186–187. Design details of combined sewage and waste disposal plant for model suburban community to serve 4,000 persons.

Plants, Herkimer, N. Y. Combined Waste Disposal Plant in Operation at Herkimer, New York. *Am. City*, vol. 52, no. 3, Mar. 1937, pp. 63–66. Plant for population of 10,500 equipped with incinerator for garbage and refuse; method of sewage treatment; equipment and costs.

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Beams, Deflection. Formulas for Deflections and Bending Moments, R. J. Roark. *Product. Eng.*, vol. 8, nos. 2 and 3, Feb. 1937, pp. 54–59 and 79–80, and Mar., pp. 118–120. Formulas for end reactions, end moments, vertical shears, bending moments, deflections, and end slopes of beams supported and loaded in various ways; cases considered have been so selected that, by superposition, formulas are applicable to almost any combination of loading and support likely to occur.

Buildings, Vibrations. Transmission of Sound and Vibration in Buildings, E. Meyer. *Soc. Motion Picture Engrs.—J.*, vol. 28, no. 3, Mar. 1937, pp. 271–283. Description of studies made at Institut fuer Schwingungforschung, Berlin, with particular reference to analogies between properties of sound insulating structures and electric networks; some of problems treated deal with air-borne transmission of sound through multiple walls; propagation of sound in building materials, and physical properties of insulating materials for structure-borne sound; and electric apparatus for measuring vibrations in buildings.

Concrete Slabs. Graphical Data for Reinforced Concrete Slabs, W. S. Wilson. *Surveyor*, vol. 91, no. 2346, Jan. 8, 1937, pp. 3637. Derivation and graphical charts of curves of loads plotted against span for freely supported and continuous slabs.

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Loaders. Eimco-Finlay Shoveling Loader. *Engineering*, vol. 143, no. 3704, Jan. 8, 1937, pp. 49–50. Illustrated description of machine for removing spoil in tunnels and mine headings; manufactured by Eimco Corporation, Salt Lake City, Utah; characterized by ingenious method of transferring spoil from working front of machine to removal car in its rear.

Vehicular, Approaches. Midtown Hudson Tunnel. South Tube. New York Approach Finish. *Port New York Authority—Contract MHT-17*, Mar. 1937, 185 pp. Detailed information on construction and installation of architectural finish, lighting and signal installation, sidewalks and emergency garage building for New York approach of south tube of Midtown Hudson Tunnel.

WATER TREATMENT

Chlorination. City of Plymouth Water Supply. *Water & Water Eng.*, vol. 38, no. 469, Oct. 1936, pp. 531–534. Description of new installation for chloramine process of sterilization; capacity of 14.5 mgd; Plymouth water-works flow diagram; plan of chloraminating plant house; proportionment of chemicals.

Paper and Pulp Mills. Significance of Water, H. L. Skinner. *Paper Trade J.*, vol. 104, no. 12, Mar. 25, 1937, pp. 67–72. Objectionable impurities of water, such as color, suspended matter, iron, manganese, and hardness, are discussed, together with methods for their removal; necessity of water softening for boiler purposes and sometimes for making up size solution is pointed out; brief comparison of softening of lime soda process and zeolite process; chlorination for slime prevention and corrective treatment for corrosive waters. Before Tech. Assn. Pulp and Paper Industry.

WATER WORKS ENGINEERING

Developments. Water Supply and Sanitary Engineering in 1936. *Engineer*, vol. 163, no. 4226, Jan. 8, 1937, pp. 56–59. Review of outstanding developments in Great Britain and other countries.

Flood Damage. Half a Million People Without Water Supply, W. S. Baum. *Water Works Eng.*, vol. 90, no. 5, Mar. 3, 1937, pp. 264–269. Emergency measures adopted in Cincinnati, Ohio, during 1937 flood; extent of damage; work of reconditioning system and renewing service.

Hong Kong. Water Supply of Hong Kong, C. A. M. Smith, Pt. II—Works on Mainland. *Water & Water Eng.*, vol. 38, no. 469, Oct. 1936, pp. 544–548. Shing Mun Valley scheme; bywash and Shek Li Pui reservoirs; raw-water reception reservoirs; system of payment; hardness of water; harbor pipe lines.

Public Utilities, Flood Damage. Electric and Water Services Crippled by Flood at Cincinnati. *Combustion*, vol. 8, no. 8, Feb. 1937, pp. 25–27. Power received over tie lines from outside sources sufficed to meet only one-seventh of normal demand, and this was allocated to certain essential services; limited amount of water in hilltop reservoirs turned on for hour daily only, and some sections of city were without water; natural gas supply was undisturbed except in few outlying sections.

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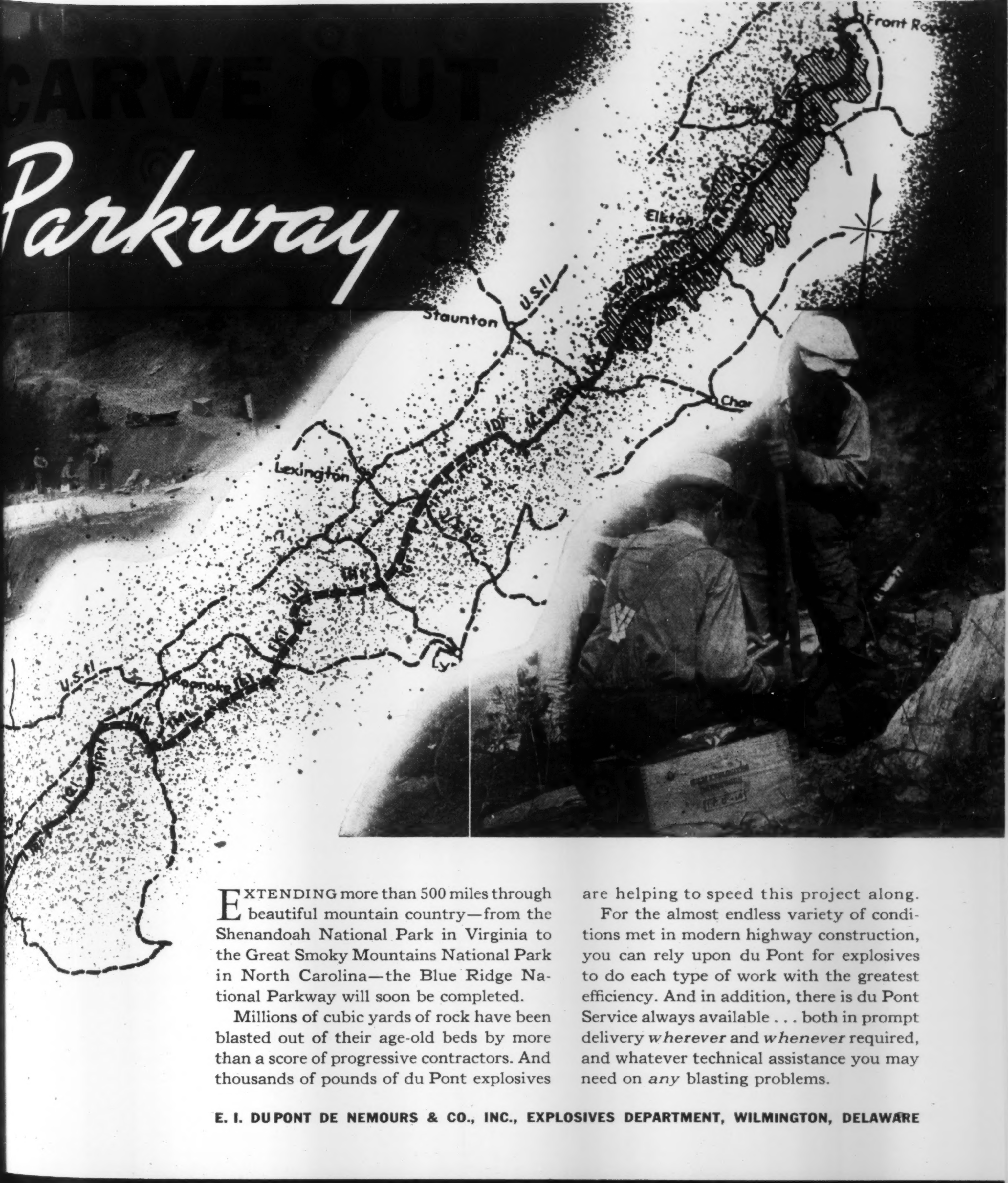

EXTENDING more than 500 miles through beautiful mountain country—from the Shenandoah National Park in Virginia to the Great Smoky Mountains National Park in North Carolina—the Blue Ridge National Parkway will soon be completed.

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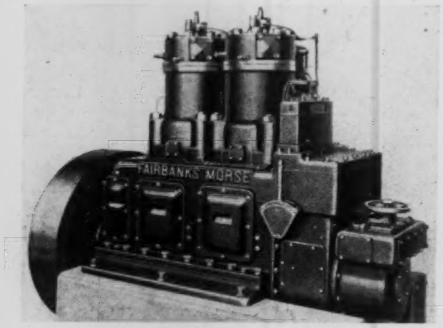
New Developments of Interest, as Reported by Manufacturers

New Heavy Duty Diesel for the Small Power User

A NEW Fairbanks-Morse Diesel, the Model 42-E, has been developed to meet the demand of small power users for a heavy-duty, continuous-service stationary engine. It is available in two- and three-cylinder combinations with ratings of 60 and 90 hp at 450 rpm, and can be furnished for direct-connected, belt, or electric generator drive.



With an $8^{3}/_{4}$-in. bore and $10^{1}/_{2}$-in. stroke, this Diesel is smaller and lighter than the F-M Model 32-E, but it embodies all of the proven features that have led to the daily use of several hundred thousand hp of the larger engines. It is small enough to be installed where space and head room are limited, and it is applicable for any power requirement within its hp ratings.

The engines are conservatively rated as to capacity, piston speed, and bearing pressures, and will operate continuously at rated capacity with no danger of overheating or of strain to any part. Further details regarding this new F-M Model 42-E Diesel will be found in a bulletin now available upon request from Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill.

Earth Exploration Devices

THE SHEPARD Earth Resistivity Meter and the Lee Geoscope are announced by the American Instrument Co., Inc., Silver Spring, Md. According to the manufacturer's report, these instruments provide a rapid, accurate, and inexpensive means of conducting subsurface explorations such as locating depth and subsurface contours of rock strata, gravel beds, clay, shale, ore bodies, etc., being applicable to any depth from 3 to 2,500 ft.

Both instruments are stated to be in successful use for road grading operations; classification of excavation materials in highway construction; location of sand and gravel deposits; foundation exploration; determinations of depths to solid bottom in marshes, etc.; location of ore bodies, water bearing strata, etc. Bulletin No. 2052 is available.

The Morse Filter Plant

THIS FILTER plant, which is reported to be one of the most important developments in the construction of water purification plants since the origin of the rapid sand filter, is interestingly described and pictured in a 10-page booklet. The basic construction features are discussed; the method of operation is described and illustrated with a clear diagram of the flow of water; and a brief summary of advantages are included in the pages of this booklet.

Copies will be forwarded by the Chicago Bridge & Iron Co., 2199 Old Colony Building, Chicago, Ill.

Hour Meter Now Standard Caterpillar Equipment

AN HOUR meter will be standard equipment on all three, four and six cylinder Diesel engines produced by the Caterpillar Tractor Co., Peoria, Ill., according to an announcement made recently. This meter was made available as an attachment about two years ago. The many that have been used during this period, have definitely proved the value of such an instrument and its use will eventually mean as much to the Diesel engine owner and operator as the speedometer does to the automobile owner.

The hour meter is a sturdy, durable unit with a large dial that is easy to read. It is attached to the rear of the fuel injection pump housing and is driven by the end of the shaft, fitting between the heads of the cap screws in the end of the fuel injection pump camshaft. The hour meter registers one number for every hour the engine operates at standard rated speed. Just as the mileage indicated by the speedometer has become the standard for measuring the life and maintenance intervals of the automobile, so will the hour meter be generally used as a guide for lubricating and maintaining the "Caterpillar" Diesel engine.

New Bottom-Dump Trailer

A NEW 18-yard bottom-dump trailer, reported to be mounted on the first actual capacity 30-ton wheels on the market, is announced by the Athey Truss Wheel Co., 5631 West 65th St., Chicago, Ill.

Embodying the tested features of previous Athey Forged-Trak Bottom-Dump Trailers, the new trailer is built to carry capacity loads wherever track-type tractors can operate. The axle and drawbar are spring-mounted to absorb loading and roading shocks. There is a simple, positive, mechanical windup. The construction of the entire unit is exceptionally rigid, the manufacturer states.

"Champion" Buckets

THE WILLIAMS "Champion" Buckets include the "Favorite" and "Hercules" Bucket Series, in sizes from $^{3}/_{8}$ to 3 cu yds. A recently published 6-page folder of the Wellman Engineering Co. of Cleveland, Ohio, covers the specifications of these buckets, discusses the general features, and gives sixteen "thumb nail" illustrations of important features of construction.

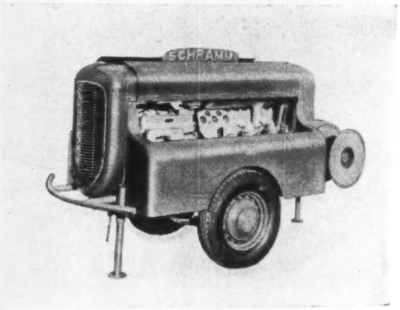
Ingersoll-Rand Jackhamer

INGERSOLL-RAND has recently introduced a new fifty-five pound Jackhamer called the JA-55. This machine, a big brother to the JA-30 and JA-45 Jackhamers, is a hard hitting, fast drilling tool designed especially for harder rock and deeper holes.

It is especially suitable for mine, quarry, and contract work. Having a low air consumption, because of an improved valve design, it is very popular for use with portable air compressors and where the air supply is limited. More information on the JA-55 will be found in Form 2337.

Schramm Compressor

A NEW, lightweight air compressor, the DeLuxe "Utility," is available in sizes 85 and 105 cu ft actual air delivery in the gasoline engine driven machines, and in the 105 cu ft size in the Diesel powered unit, according to the announcement of Schramm, Inc., West Chester, Pa.



Compressor features include four cylinder, vertical block with lighter pistons; five main bearings; force feed lubrication supplied by gear driven oil pump to all movable parts; mechanical intake valves operated from camshaft in perfect timing with piston travel; electric self-starting, and the Schramm self-aligning clutch between engine and compressor. The DeLuxe "Utility" is a complete air plant with air and gas tanks compactly under the hood. Skid mounted, this outfit is semi-portable. Portable mountings are offered in the form of a two wheel pneumatic tire spring trailer. Bulletin No. 3700 will be forwarded.

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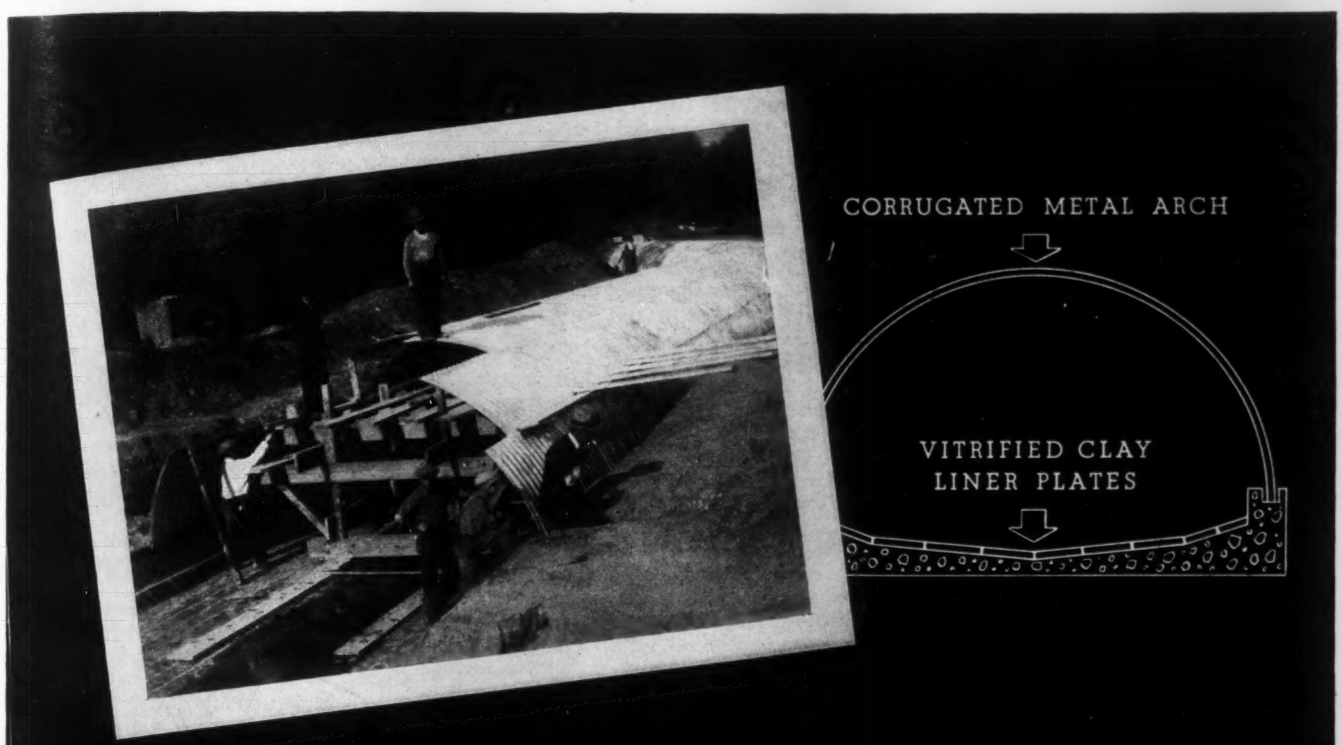

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Besides these superior structural qualities, Multi Plate also assures a high degree of material permanence. Many Armco Ingot Iron sewers, made of 14 and 16 gage galvanized metal, are sound and strong today after *30 years of service*. This same metal in Multi Plate is *3 to 4 times as thick* and the galvanized coating is much heavier. For more specific data bearing on your problems, address the coupon to: Armco Culvert Mfrs. Association, Middletown, Ohio.

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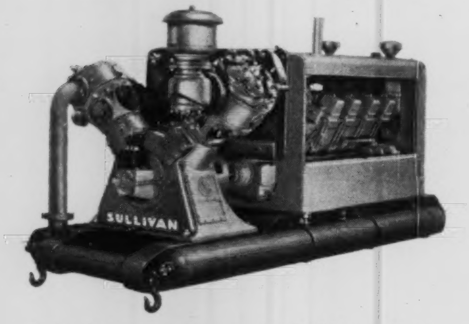
New Air Compressor Line

SULLIVAN MACHINERY CO. announces a new line of "V" Vertical air compressors particularly suited to construction, tunneling, and mining where air capacities greater than obtainable from portable compressors are desired. Known as the WN-102 series, these compressors are available in three sizes: 445, 550, and 720 cu ft. per min actual air delivery (displacement 536, 660, and 856 cu ft per min). The design is two-cylinder "V" type, two-stage, and double-acting. These compressors are extremely compact and can be moved from one job to another by truck or trailer. Each size is self contained and requires no water service connections for cooling.

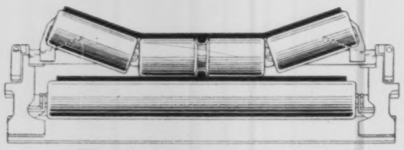


Any type of drive—direct connected, "V" belt, or flat-belt—can be used with Diesel or gasoline power units or electric motor. Either complete units consisting of compressor and power unit on skid type bases or the compressor only can be supplied.

Qualities stressed in the manufacturer's report are smooth running balance, maximum power economy, precision construction throughout, ability to give reliable service over a long period of life, ease of transportation, and minimum set-up expense.

Center-Guide Belt Conveyor

IN STEP with the growing trend to use belt conveyors underground for low-cost long-distance transportation Link-Belt Co., Chicago, Ill., announces that it has developed a center-guide belt conveyor which is particularly well suited for use in shallow seams, and on uneven floor surfaces. Installations have been made in seams as low as 30 in.



The feature consists of a conveyor belt molded with a continuous central guide strip on the underside, and the use of anti-friction conveyor idlers having a central roll with a deep groove within which the guide strip is confined in both runs. Actual operation has shown that the belt maintains its central carrying position at all times, even when the conveyor is tilted sidewise at a considerable angle, thus making it unnecessary to use side guide idlers.

Folders Announced

BELT CONVEYORS—This catalog of belt conveyor equipment and engineering data, developed for the convenience of the belt conveyor user and the designing engineer, contains complete and specialized information on the design and application of belt conveyors for the handling of all bulk materials, together with full listing and description of all belt conveyor equipment. There is also included design information and specifications for completely standardized Rex Belt Conveyors. Charts and tables are provided for quick and convenient selection of the proper unit for any particular requirements, together with dimension drawings of all units. Chain Belt Co., Milwaukee, Wis.

JACKS—Hydraulic hand and service jacks for automotive, industrial, and construction use are described and illustrated in catalog No. 337, 16 pages, $8^1/_2$ by 11 in. Blackhawk Manufacturing Co., Milwaukee, Wis.

LOCOMOTIVE CRANES — A pictorial booklet of 16 pages, $8^1/_2$ by 11 in., outlines the application and wide range of usefulness of this equipment. American Hoist & Derrick Co., St. Paul, Minn.

MERCURY LIGHTING—Many types of industrial lighting equipment for use with 200 and 400 watt high intensity mercury vapor lamps, combination mercury-incandescent units and vapor proof units are described in Catalog Section 61–180. Included is information on designing an installation, choosing mounting heights, spacing and size of units for different wall and ceiling conditions, and average resultant lighting intensity. Lighting Division, Westinghouse Electric and Manufacturing Co., Cleveland, Ohio.

PUMPS—Ball bearing centrifugal pumps, approved by the National Board of Fire Underwriters and the Associated Factory Mutual Fire Insurance Companies, are described in Bulletin 5814 F. These F-M Centrifugal Fire Pumps are instantly ready to operate at full capacity and pressure. They provide a steady, non-pulsating flow with uniform pressures, and at shut-off or maximum pressures can operate against a closed valve without damage to pump mechanism or connecting pipe. The pumps are offered with electric motor, gasoline engine, steam turbine, dual motor and engine, and dual motor and turbine drives. Fairbanks, Morse & Co., Chicago, Ill.

ROAD MACHINERY—Pictures and captions describe the various phases of road building and tell the story of "Caterpillar" Track-type Tractors and road machinery at work in all corners of the globe. A feature of the booklet, Form 4046, is the tracing of the construction of a pioneer road from start to finish—from removing trees and stumps from the right of way to finishing the dirt road with a Diesel tractor and blade grader. Caterpillar Tractor Co., Peoria, Ill.

SEWAGE TREATMENT—A booklet of 22 pages, entitled Measurement, Control, and Chemical Treatment of Sewage and Sludge covers the various Venturi tubes, metering instruments, and the "long distance" Chronoflo Meter of the Builders Iron Foundry, Providence, R.I.

SHEET PILING—Larssen Steel Sheet Piling is described in a 32-page catalog. This booklet describes features of Larssen Piling and Union Steel Trench Sheeting, illustrates all types of sections with tabulation of physical characteristics, and contains data, diagrams, and installation photos. Steel Union-Sheet Piling, Inc., 75 West St., New York, N.Y.

SHOVEL—An attractive catalog of 24 pages, $8^1/_2$ by 11 in. covers thoroughly the versatility of the Model 18 shovel, crane, dragline, truck shovel, and truck crane. Illustrations include job-use photographs, cuts of its rugged construction details, and sketches of specification details and operating ranges. Northwest Engineering Co., Chicago, Ill.

STREET LIGHTING EQUIPMENT—New catalog sections describing standards and fittings have been announced as additions to the Westinghouse Street Lighting Equipment Catalog. These sections include descriptions of cast iron standards, hollowspun granite standards, Union Metal steel standards, top sections and casings for standards, brackets and equipment for poles, and ornamental crooks. Other catalog sections describe several types of luminaires, and their new design principles. Westinghouse Electric and Manufacturing Co., Cleveland, O.

TILE—A low-cost structural roofing tile is announced in a 4-page, $8^1/_2$ by 11 in. folder. Natco Dek-Tile is claimed to be permanent and fireproof. The units, assembled, cemented, and bolted together are placed on the roof frame in sections. National Fireproofing Corp., Pittsburgh, Pa.

VIBRATORS—The Mall Internal Concrete Vibrators, with their varied attachments, are described and illustrated in a four-page bulletin. Mall Tool Co., 7740 So. Chicago Ave., Chicago, Ill.

WATER WORKS DATA BOOK—This book contains interesting descriptive matter and data relating to Hydro-Tite self-caulking jointing compound for cast iron bell and spigot water mains. About one half of the 48 pages are devoted to water works tables, charts, and graphs and short treatises on many water works subjects. A pipe flow diagram derived from Williams & Hazen tables is one of the useful features. Hydraulic Development Corp., 50 Church St., New York, N.Y.

WELDERS—The Arc-Welding of Tomorrow, bulletin No. W10, tells just what single current control means to the operator—what improvement it makes on the finished welded product. Action photos illustrate the uses of the many Smootharc models—from the vertical 75 and 100 ampere types to the 200, 300, 400, and 600 ampere horizontal models. Stationary and portable-trailer Smootharcs are also shown. Harnischfeger Corp., Milwaukee, Wis.

WELDERS—ENGINE DRIVEN—Westinghouse engine driven welders, single operator, 200–300–400 ampere sets are described in a recent publication which includes performance curves of the welder, fuel consumption curves of the engines, and general descriptions of the welders and power units. Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

Are your original Cast Iron Mains in Service?

We asked 212 cities whether the *original cast iron lines* in their water distribution systems were still in service—also the age of the oldest cast iron pipe in service. Their answers are shown in the tabulation. Only a material with great bursting strength, beam strength, crushing strength, impact strength, and effective resistance to corrosion—the five indispensable requirements of an underground main—can render such enduring and economical service.

204 OUT OF 212 CITIES SAY . . .

Yes

SYMBOLS: ✪ *In service 100 years or more* □ *50 to 99 years* ○ *under 50 years*

SOLID SYMBOLS INDICATE ORIGINAL PIPE IN SERVICE

- **ALABAMA**
  - □ Birmingham
  - ■ Mobile
  - ■ Tuscaloosa
- **ARKANSAS**
  - ■ Fort Smith
  - ■ Little Rock
- **CALIFORNIA**
  - ● Alhambra
  - ● Fresno
  - ● Long Beach
  - ■ Oakland
  - ■ Pasadena
  - ■ San Diego
  - ■ Los Angeles
  - ■ Sacramento
  - ■ San Francisco
  - ■ Stockton
- **COLORADO**
  - ■ Denver
  - ● Fort Collins
  - ■ Pueblo
- **CONNECTICUT**
  - ■ Hartford
  - ■ New London
  - ■ Stamford
- **DELAWARE**
  - □ Wilmington
- **DISTRICT OF COLUMBIA**
  - ■ Washington
- **FLORIDA**
  - ■ Jacksonville
  - ■ Orlando
  - ● St. Augustine
  - ● West Palm Beach
- **GEORGIA**
  - ■ Atlanta
  - ■ Augusta
  - ● Decatur
  - ■ Macon
- **IDAHO**
  - ● Boise
  - ● Pocatello
- **ILLINOIS**
  - ● Berwyn
  - ■ Bloomington
  - ■ Chicago
  - ■ Elgin
  - ■ Evanston
  - ■ Galesburg
  - ■ Moline
  - ■ Oak Park
  - ■ Peoria
  - ■ Quincy
  - ■ Rockford
- **INDIANA**
  - ■ Elkhart
  - ■ Evansville
  - ■ Fort Wayne
  - ● Gary
  - ■ Indianapolis
  - ■ La Fayette
  - ■ Michigan City
  - ■ Richmond
  - ■ Terre Haute
- **IOWA**
  - ■ Burlington
  - ■ Davenport
  - ■ Des Moines
  - ■ Dubuque
  - ■ Ottumwa
- **KANSAS**
  - ■ Hutchinson
  - ■ Topeka
- **KENTUCKY**
  - ■ Covington
  - ■ Louisville
  - ■ Paducah
- **LOUISIANNA**
  - ● New Orleans
  - ■ Shreveport
- **MAINE**
  - ■ Bangor
  - ■ Portland
- **MARYLAND**
  - ★ Baltimore
  - ■ Hagerstown
- **MASSACHUSETTS**
  - ■ Boston
  - □ Brockton
  - ■ Cambridge
  - ■ Chelsea
  - □ Fall River
  - ■ Fitchburg
  - ■ Holyoke
  - ■ Lowell
  - ● Malden
  - ■ New Bedford
  - ■ Newton
  - ● Revere
  - □ Somerville
  - ■ Springfield
  - ■ Taunton
  - ■ Waltham
  - ■ Worcester
- **MICHIGAN**
  - ■ Ann Harbor
  - ■ Battle Creek
  - ■ Bay City
  - ● Dearborn
  - ■ Detroit
  - ■ Flint
  - ■ Grand Rapids
  - ● Hamtramck
  - ● Highland Park
  - □ Kalamazoo
  - ■ Muskegon
  - ■ Port Huron
- **MINNESOTA**
  - ■ Duluth
  - ■ Minneapolis
  - ■ St. Paul
- **MISSISSIPPI**
  - ● Jackson
  - ■ Vicksburg
- **MISSOURI**
  - ★ St. Louis
  - ■ Kansas City
  - ■ Springfield
- **MONTANA**
  - ● Billings
  - ● Great Falls
  - ● Missoula
- **NEBRASKA**
  - ■ Lincoln
  - ■ Omaha
- **NEW HAMPSHIRE**
  - ● Berlin
  - ■ Concord
  - ■ Manchester
  - ■ Nashua
- **NEW JERSEY**
  - ■ Atlantic City
  - ● Elizabeth
  - ■ Hoboken (Hackensack Water Co.)
  - ■ Jersey City
  - ■ Newark
  - ■ New Brunswick
  - ■ Paterson
  - ● Plainfield
- **NEW YORK**
  - ■ Amsterdam
  - ■ Binghamton
  - ■ Elmira
  - ■ Jamestown
  - ■ Kingston
  - ■ Mt. Vernon
  - ■ New Rochelle
  - ✪ New York City
  - ● Niagara Falls
  - ■ Rochester
  - ■ Syracuse
  - ■ Utica
  - ■ Yonkers
- **NEW MEXICO**
  - ● Roswell
- **NORTH CAROLINA**
  - ■ Asheville
  - ■ Charlotte
  - ■ Durham
  - ● Greensboro
  - ● High Point
  - ● Raleigh
  - ■ Wilmington
- **NORTH DAKOTA**
  - ■ Bismark
  - ■ Fargo
  - ■ Grand Falls
- **OHIO**
  - ■ Akron
  - ■ Cincinnati
  - ■ Cleveland
  - ● Cleveland Hts.
  - ■ Columbus
  - ● East Cleveland
  - ■ Hamilton
  - ■ Lima
  - ● Marian
  - ■ Newark
  - ■ Toledo
  - ■ Warren
  - ■ Youngstown
- **OKLAHOMA**
  - ● Ada
  - ● Enid
  - ● Oklahoma City
- **OREGON**
  - ● Eugene
  - ■ Portland
- **PENNSYLVANIA**
  - ■ Erie
  - ■ Jamestown
  - ★ Lancaster
  - ■ New Castle
  - ★ Philadelphia
  - □ Pittsburgh
  - ★ Reading
  - ● Wilkensburg
  - ■ York
- **RHODE ISLAND**
  - ■ Cranston
  - ■ Pawtucket
  - ■ Providence
  - ■ Woonsocket
- **SOUTH CAROLINA**
  - ■ Charleston
  - ● Greenville
  - ■ Spartanburg
- **TENNESSEE**
  - ■ Chattanooga
  - ■ Knoxville
  - ■ Nashville
- **TEXAS**
  - ■ Dallas
  - ■ Fort Worth
  - ● San Angelo
  - ■ Texarkana
- **UTAH**
  - ■ Provo
  - ■ Salt Lake City
- **VIRGINIA**
  - ★ Lynchburg
  - ● Newport News
  - ■ Norfolk
  - ■ Petersburg
  - ● Portsmouth
  - ★ Richmond
- **WASHINGTON**
  - ● Bellingham
  - ■ Seattle
  - ■ Tacoma
- **WEST VIRGINIA**
  - ● Clarksburg
  - ★ Wheeling
- **WISCONSIN**
  - ■ Eau Claire
  - ■ Fond DuLac
  - ■ Green Bay
  - ● Kenosha
  - ■ Madison
  - ■ Milwaukee
  - ■ Oshkosh
  - ■ Racine
  - ● Sheboygan
  - ● Superior
  - ● West Allis

NOTE: In a few instances gas mains are referred to where they are older than water mains.

THE CAST IRON PIPE RESEARCH ASSOCIATION
Thos. F. Wolfe, Research Engineer, 1013 Peoples Gas Bldg., Chicago

Transportation Inspector, Office of Gen. Supt., Chesapeake & Ohio Ry. Refers to L. B. Allen, F. Bass, G. D. Brooke, H. M. Church, H. E. Kirby, J. E. Teal.

Crow, Thomas Otho, Jun., San Bernardino, Calif. (Elected Dec. 22, 1930.) (Age 32.) Jun. Bridge Constr. Engr., Bridge Dept. with California Div. of Highways. Refers to W. V. Brady, C. Derleth, Jr., H. Goodridge, C. G. Hyde, F. W. Panhorst, D. R. Warren.

DeMartini, Frank Edward, Jun., San Francisco, Calif. (Elected Oct. 10, 1927.) (Age 32.) Water Purification Engr., San Francisco Water Dept. Refers to G. E. Arnold, N. A. Eckart, T. W. Espy, C. G. Gillespie, C. G. Hyde, E. A. Reinke.

Diehl, Ray Purdy, Jun., Albany, N.Y. (Elected Oct. 14, 1930.) (Age 29.) Cons. Engr. Refers to A. G. Chapman, M. C. Cleveland, G. C. Diehl, R. G. Finch, E. A. Touceda, R. C. Wheeler.

Goddard, James Elmer, Jun., Knoxville, Tenn. (Elected Oct. 1, 1928.) (Age 30.) Asst. Hydr. Engr. in charge of Field Investigation Sec., Eng. Data Div., with TVA. Refers to B. B. Brier, A. S. Fry, R. E. Hutchins, N. H. Sayford, G. D. Whitmore, H. A. Wiersema, J. H. Wilkinson.

Hersey, Edwin Spaulding, Jun., Carson City, Nev. (Elected Aug. 15, 1932.) (Age 32.) Designer, Nevada State Highway Department. Refers to R. C. Booth, E. C. Brown, W. L. Chadwick, C. L. Hill, F. B. Laverty, R. W. Spencer, I. L. Tyler.

Huffine, William Byrd, Jun., Cheyenne, Wyo. (Elected Jan. 25, 1932.) (Age 27.) Bureau Mgr., Wyoming State-Wide Highway Planning Survey. Refers to T. W. Allen, L. F. Copeland, A Diefendorf, J. A. Elliott, R. A. Klein, C. E. Learned, H. T. Person.

LaBelle, Walter Ernest, Jun., Chicago, Ill. (Elected Oct. 14, 1930.) (Age 29.) Res. Engr. and Designer, Chicago Erection Dept., Bethlehem Steel Co. Refers to W. B. E. Anthony, E. J. Christenson, H. Cross, P. A. Franklin, C. H. Harlan, W. C. Huntington.

LeSueur, Benjamin Wilmar, Jun., Baltimore, Md. (Elected July 16, 1928.) (Age 32.) Jun. Asst. Bridge Engr., Maryland State Roads Comm. in charge of drafting room. Refers to E. R. Allen, H. H. Allen, J. E. Greiner, R. M. Reindollar, O. H. Schroedl, S. S. Steinberg.

Lidicker, William Zander, Jun., St. Paul, Minn. (Elected Oct. 1, 1928.) (Age 32.) Engr., U. S. Engr. Office. Refers to J. B. Alexander, H. M. Hill, G. E. Lyon, J. L. Southworth, G. M. Tapley, L. F. Van Hagan.

Long, Gordon Lucas, Jun., Sacramento, Calif. (Elected Nov. 10, 1930.) (Age 33.) Res. Engr., Div. of Highways, Bridge Dept. Refers to R. S. Carberry, M. J. Dowd, A. D. Edmonston, G. H. Jones, F. W. Panhorst, F. W. Slattery, A. L. Trowbridge.

Mead, John David, Jun., New York City. (Elected Nov. 14, 1927.) (Age 30.) Engr., Brooklyn (N.Y.) Eastern Dist. Terminal. Refers to A. L. Andujar, F. R. W. Cleverdon, C. T. Schwarze, H. H. Shepard, C. H. Snow, R. N. Spooner, D. S. Trowbridge.

Momchiloff, Momchil Stephen, Jun., New York City. (Elected June 15, 1936.) (Age 33.) Designer with Gibbs & Hill, Cons. Engrs. Refers to E. H. Anson, C. W. Coote, A. D. Fields, C. H. Hurley, L. W. Joseph.

Ortolani, Lawrence, Jun., Cleburne, Tex. (Elected Oct. 14, 1929.) (Age 32.) Res. Engr., Texas State Highway Dept. Refers to D. H. Askew, C. M. Davis, C. T. Holmes, W. O. Jones, F. E. Lovett, R. Pace, M. C. Welborn.

Riggs, Charles Edward, Jun., El Cerrito, Calif. (Elected Jan. 13, 1936.) (Age 32.) With Pacific Gas & Elec. Co. Refers to J. F. Barber, H. B. Campbell, M. C. Collins, T. J. Corwin, Jr., T. E. Ferneau, A. S. Gelston, J. L. Mathias.

Schnackenberg, Ellis Carl, Jun., Onehunga, Auckland, New Zealand. (Elected July 31, 1933.) (Age 29.) Asst. Engr., Public Works Dept.; Capt., New Zealand Artillery. Refers to T. G. G. Beck, E. A. Gibson, A. G. Park, E. H. Rhodes, J. Tyler, A. Tyndall.

Thurber, Paul, Jun., Guymon, Okla. (Elected Jan. 23, 1933.) (Age 33.) San. Engr., Panhandle Dist., State Dept. of Public Health. Refers to W. L. Benham, J. F. Brookes, L. M. Bush, R. V. Lindsey, B. S. Myers, E. R. Stapley, N. E. Wolfard.

Van Kleeck, Leroy Winfield, Jun., Hartford, Conn. (Elected Oct. 10, 1927.) (Age 32.) Senior San. Engr., Connecticut State Dept. of Health. Refers to H. W. Buck, G. E. Griffin, L. Perry, W. J. Scott, A. D. Weston, E. Wright.

Weddington, Charles Foreman, Jun., Houston, Tex. (Elected Oct. 24, 1932.) (Age 30.) Acting Res. Engr., Texas State Highway Dept. Refers to R. E. Killmer, J. M. Nagle, L. A. Peterman, R. W. Stiles, P. G. Young.

Winschuh, Albert Joseph, Jun., Totowa Borough, N.J. (Elected Oct. 30, 1933.) (Age 32.) Eng. Draftsman, New York Central R.R. Refers to W. N. Cervino, L. W. Clark, C. D. Geiger, M. P. Petrenko, A. Verduin.

Wolfskill, Kenneth Barnett, Jun., Indianapolis, Ind. (Elected Oct. 10, 1927.) (Age 31.) Squad Chf., Design Office, Indiana State Highway Comm. Refers to R. E. Davis, C. Derleth, Jr., C. A. Ellis, J. T. Hallett, G. R. Harr, M. R. Keefe, F. Kellam.

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

Men Available

These items are from information furnished by the Engineering Societies Employment Service, with offices in Chicago, New York, and San Francisco. The Service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 87 of the 1937 Year Book of the Society. To expedite publication, notices should be sent direct to the Employment Service, 31 West 39th Street, New York, N.Y. Employers should address replies to the key number, care of the New York Office, unless the word Chicago or San Francisco follows the key number, when it should be sent to the office designated.

Construction

Engineer-Estimator; Assoc. M. Am. Soc. C.E; 35; married; 15 years experience on the design, estimating, and construction of school, office, and industrial buildings for engineers and general contractors. Will travel. Available immediately. C-63.

Construction Engineer; Assoc. M. Am. Soc. C.E.; 39; graduate civil engineer; registered professional engineer, state of Pennsylvania; 13 years experience, including railroad maintenance, dredging, many types of heavy concrete and steel construction, land surveying—over 6 years on two of largest suspension bridges. Available immediately. C-64.

Construction Engineer-Estimator; Assoc. M. Am. Soc. C.E.; graduate; 36; married; 13 years experience with building contractors, office buildings, schools, hospitals, industrial reinforced concrete buildings, estimating, purchasing, job management; 1 year water supply and sewage disposal. Eastern states only. C-65.

Construction Engineer; Assoc. M. Am. Soc. C.E; Associate Member, Western Society of Engineers; 33; married; 10 years progressive experience, dams, hydroelectric power plants, flood control, bridges, buildings, and water mains; 2½ years soil erosion control work. Desires permanent position with contractor or engineering firm. Capable of taking charge. Now employed. Available reasonable notice. C-70.

Executive

Building and Construction Engineer; M. Am. Soc. C.E.; 55; B. S. in C.E; licensed professional engineer, New York State. Executive, engineer, estimator on building construction work with general contractors. Successful in handling men and in getting new business. Building appraisals, reports, etc. Seeks employment or association. C-52.

Chemical and Civil Engineer; Assoc. M. Am. Soc. C.E.; Associate Member, American Chemical Society; with extensive industrial experience, chemical, metallurgical, oil refining, plants, and equipment. Design, construction, and operation. Seeks position with manufacturer, contractor, engineering, or management company, in planning new developments, plant economies, market, and patent research. C-53.

Consulting-Constructing Engineer; M. Am. Soc. C.E.; who for over 20 years has gone to the Far East, South America, and the West Indies, locating and building railroads and highways, water supplies, hydroelectric plants, reporting on same for investment or improvements, is open for an engagement. Can go at once. C-61.

Civil Engineer; Assoc. M. Am. Soc. C.E.; graduate; executive with 20 years experience in management, operating, personnel, construction, valuation, and planning low-cost housing project, large projects in South. Now in government service. Desires new connection. Married. Excellent health. Best fitted for administrative, organizing, or operating tasks. Will consider what you have to offer. C-67.

Engineer; M. Am. Soc. C.E.; graduate, 1921; 38; married; 16 years varied experience with manufacturer, consulting engineer, sales organization, and contractor; experience includes management, sales, purchasing, building designs and specification, contracts, estimates, and supervision. Desires permanent position with opportunity. C-74.

Steel Storage Tanks and Equipment for the Process Industries

During recent years the process industries have been accounting for more and more of the manufactured goods produced. Many new products have been developed as well as new methods of making familiar products better and more economically.

Process industries require storage facilities of all kinds—tanks for raw materials, tanks and pressure vessels during the process of manufacture and tanks for various grades of finished goods. Process plants also require tanks for water, for fuel oil, for acids, and innumerable other liquids.

We build elevated steel tanks and steel storage tanks in a complete range of standard capacities. Also field erected structures of special design and welded pressure vessels to meet specific requirements.

• •

The above illustration shows three fermenters with a capacity of 250,000 gals. each erected for the American Commercial Alcohol Corp. at Philadelphia, Pa. They illustrate a typical process installation. Write our nearest office when designing equipment of this type.

CHICAGO BRIDGE & IRON COMPANY

Chicago..............2199 Old Colony Bldg.
Detroit..............1541 LaFayette Bldg.
Cleveland...........2263 Rockefeller Bldg.
New York.......3395—165 Broadway Bldg.
Boston..........1545 Consolidated Gas Bldg.
Philadelphia.......1652-1700 Walnut Street
Dallas..............1485 Liberty Bank Bldg.
Houston......................2919 Main Street
Tulsa.......................1647 Hunt Bldg.
Birmingham..............1695 N. 50th Street
San Francisco..............1084 Rialto Bldg.
Los Angeles............1456 Wm. Fox Bldg.

B-512

PLANTS in BIRMINGHAM, CHICAGO and GREENVILLE, PENNA.

Engineer; Assoc. M. Am. Soc. C.E.; 41; single; 15 years experience in engineering department of first-class railroad. Railroad and bridge construction and valuation work; 11 years responsible charge. Familiar with all types of construction. Thoroughly experienced in drafting contracts and specifications. Experience as office engineer and estimator; 1 year and 4 months examining plans, specifications, and contracts for PWA. C-62.

Executive, Construction Manager, Chief Engineer, General Superintendent; M. Am. Soc. C.E; civil engineer with legal knowledge. Now chief engineer. Over 25 years extensive domestic and foreign experience, principally supervising for builders many types of heavy engineering construction and building structures—some of very large dimensions. Excellent health; "go-getter" for economic methods; quality construction. Reasonable notice. C-69.

Civil Engineer; Assoc. M. Am. Soc. C.E.; graduate, Iowa State College; 50; married. Long, varied experience design, construction, inspection, research in connection with irrigation, flood control dams, other hydraulic structures. Actual experience and natural inclination indicate employment in the order of preference as follows: designing, office management, construction, investigation and reports, research. C-66.

Junior

Civil Engineer; Jun. Am. Soc. C.E.; 28; B.S. C.E., Ohio Northern University, 1931; majored in structures and hydraulics; Ohio registration; 7 years engineering experience—$1^1/_2$ years as chief of mine survey party, $5^1/_2$ years in state highway department ($4^1/_2$ years as assistant engineer in charge of plans and design). Skilled draftsman. Some teaching experience in Ohio Northern University. Desires opportunity for research or teaching. C-55.

Civil Engineer; Jun. Am. Soc. C.E.; 23; single; B.S.C.E., University of Idaho, 1936; 6 months experience in aeronautical design and detailing; 5 months experience as structural steel detailer; 9 months experience as rodman; 3 months experience as checker on blister rust control. Desires position in construction or sales. C-50.

Civil Engineer; Jun. Am. Soc. C.E.; 29; single; B.S.C.E., Drexel Institute of Technology, 1931; 1 year as timekeeper on construction work; 5 years, hydraulic turbine and pump testing, model and field. Desires change—permanent position with opportunity. Prefers Pennsylvania, New York, or adjoining states. Available one month's notice. Excellent references. C-48.

Engineer; Jun. Am. Soc. C.E.; 24; married; $2^1/_2$ years engineering experience, surveying, and on design and construction of concrete, earthwork, etc. Has handled men. Not afraid to work hard. Graduate civil engineer, 1934. Desires job giving maximum experience. C-60.

Civil Engineer; Jun. Am. Soc. C.E.; 30; graduate of Columbia University (B.A. physics and chemistry) and University of Colorado (civil engineering); desires position in technical sales or writing work after four years general and highway construction and three years personnel, statistical, general office, and free-lance writing. C-54.

Civil Engineer; Jun. Am. Soc. C.E.; 27; B.C.E., Brooklyn Polytechnic Institute; 5 years experience in utility and building construction. Acted as contractor's engineer in charge of layout, inspection, time, and material reports. Assistant engineer, town development; assistant engineer, park department, in charge of field engineering; assistant airport engineer, Pan-American Airways Systems. References. Available immediately. C-57.

Concrete Technician; Jun. Am. Soc. C.E.; 27; B.S.C.E., M.S., Lehigh University; experience as concrete technician on federal housing project; over 2 years experience on highway construction; also experience in materials testing, supervision, and maintenance. Desires position as concrete technician or materials testing engineer in field, laboratory, or teaching. Location, East or South. Available. C-58.

Civil Engineer; Jun. Am. Soc. C.E.; 24; married; B.S. in C.E., Lehigh University, 1933, high honors; 3 summers assistant in surveying school; 4 years on rolled-earth dams and concrete work (including surveying, inspection, and 2 years in charge of soils and concrete laboratory). Desires position with engineering or industrial firm. C-56.

Graduate Civil Engineer; Jun. Am. Soc. C.E.; graduate, Carnegie Institute of Technology, 1932; single; 28; about 3 years experience as an instrumentman on construction work. About 2 years experience as a chief of party with Pennsylvania Department of Highways. Would like to get into field or design work or a combination of the two. Pittsburgh district preferred. C-59.

Civil Engineer; Jun. Am. Soc. C.E.; 26; single; B.S.C.E., University of Kentucky, 1931; $5^1/_2$ years highway experience; one year field experience on construction and location; $4^1/_2$ years in central office as engineering draftsman; 4 months structural drafting, detailing. Desires permanent job with future, not necessarily in line with past experience. Would like design or construction work. C-68.

Civil Engineer; Jun. Am. Soc. C.E.; 26; single; B.S.C.E., New York University; study in water supply and sanitary engineering; 6 months experience as assistant town assessor; 3 months experience as town inspector in construction work. Desires position in either sanitary engineering or construction work. Excellent references. Location, New York City or vicinity. C-71.

Civil Engineer; Jun. Am. Soc. C.E.; 26; single; B.S. in C.E., New York University; $1^1/_2$ years surveying; $1^1/_2$ years inspection with a construction company; 1 year as inspector on flood-control projects; $1^1/_2$ years on problems of flood-control work. Graduate studies in hydraulics. Location, eastern United States. Available on 2 weeks notice. C-75.

Teaching

Assistant Professor; Assoc. M. Am. Soc. C.E.; 36; B.S., M.S., and C.E. degrees; 7 years successful teaching experience, university and state college faculties; 7 years commercial work on railroad construction and editorial staff of engineering publication; now employed. Desires position teaching civil engineering, especially interested in transportation, highways, traffic surveys, and structural design. C-49.

Instructor, Civil and Highway Engineering; Jun. Am. Soc. C.E.; 31; single; C.E. degree, Pennsylvania State College; majored in highway engineering; minored in city planning, city manager; 5 years highway engineering, surveys design, construction, research; 2 years as instructor (engineering mathematics); experienced tutor; public speaker; engineering publicity, publication work. Position on university faculty desired with opportunity for research study. C-51.

Professor of Civil Engineering; M. Am. Soc. C.E.; married; 49; university graduate, B.S. in C.E. and C.E.; Sigma Xi, Tau Beta Pi; Registered professional engineer; 24 years teaching in college and university; 5 years practical experience in design. Specialist in mechanics and structural field. Inventor. At present employed. Will consider change. C-72.

Civil-Hydraulic Engineer; Assoc. M. Am. Soc. C.E.; 33; B.S.C.E. and C.E. degrees, with graduate work in hydraulics; 5 years experience teaching engineering drawing and descriptive geometry, and 5 years experience in hydraulic, sanitary, highway, railroad, and highway bridge design; would like position on university faculty. C-73.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1937. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Canada. Dept. of the Interior, Topographical and Air Service Bureau. New Chibougamau Map, Quebec, Sheet No. 32 G (provisional edition). (National Topographic Series) Ottawa, Canada. 1 map, 2 pp. text, 24 × 30 in., linen, apply.

This map covers a region extending about 69 miles north and south, and 90 miles east and west, situated in Quebec province, about 300 miles north of Ottawa or Montreal. Gold and copper deposits occur in the region. The map is on a scale of four miles to one inch. Canoe routes, townships boundaries, marshes, wooded areas, elevations above sea-level, and other information are shown. The map is published in regular sheet style, in a folder with index, and on linen.

(A) Decade of Bridges, 1926–1936. By W. J. Watson. Cleveland, Ohio, J. H. Jansen, 1937. 125 pp., illus., diagrs., 11 × 8 in., cloth, $4.50.

A companion volume to the author's *Bridge Architecture*, carrying the list of notable bridges on up to 1936. Both architectural features and engineering data are given for one hundred bridges selected for their illustration of novel or modern tendencies in bridge design. There are photographs or diagrams of about seventy of them. Appendices give a list of contracting firms responsible for the construction work, and a bibliography of magazine articles describing the bridges is included in the text.

Electric Power Development in the U.S.S.R. Ed. by U. S. S. R. Committee for International Scientific and Technical Conferences, Krzizhanovsky Power Institute of the Academy of Sciences of the U.S.S.R. London, Lawrence & Wishart, Ltd., 1936, 496 pp., illus., diagrs., charts, maps, tables, 9 × 6 in., cloth, $3.

This volume was prepared for the Third World Power Conference in Washington by the members of the scientific staff of the Krzizhanovsky Power Institute of the Academy of Sciences of the U.S.S.R. It is an exposition of the principal technical and economic problems of electrical development in the Soviet Union, and of the plans for meeting them. Much information upon the engineering principles applied in the design of steam and hydraulic electric plants, transmission systems, etc., is included.

First Course in Statistical Method. By G. I. Gavett. 2 ed. New York and London, McGraw-Hill Book Co., 1937. 400 pp., diagrs., charts, tables, 9 × 6 in., cloth, $3.50.

A textbook for use as a foundation course in "Statistical Method" for all the various fields in which the mathematical representation of facts is desirable. Only fundamental material, from which a student can proceed in any desired direction, is included. Several appendices present simple, brief explanations of such basic mathematical manipulations as are necessary to follow the text.

Fluid Mechanics. By R. A. Dodge and M. J. Thompson. New York and London, McGraw-Hill Book Co., 1937. 495 pp., illus., diagrs., charts, tables, 9 ×6 in., cloth, $4.

This is an elementary textbook covering the field of fluid mechanics. Planned and developed in accordance with recent trends in engineering education, the book offers a treatment of the fundamental principles common to hydrostatics, hydraulics, hydromechanics, and aerodynamics. There are many illustrative examples and problems.

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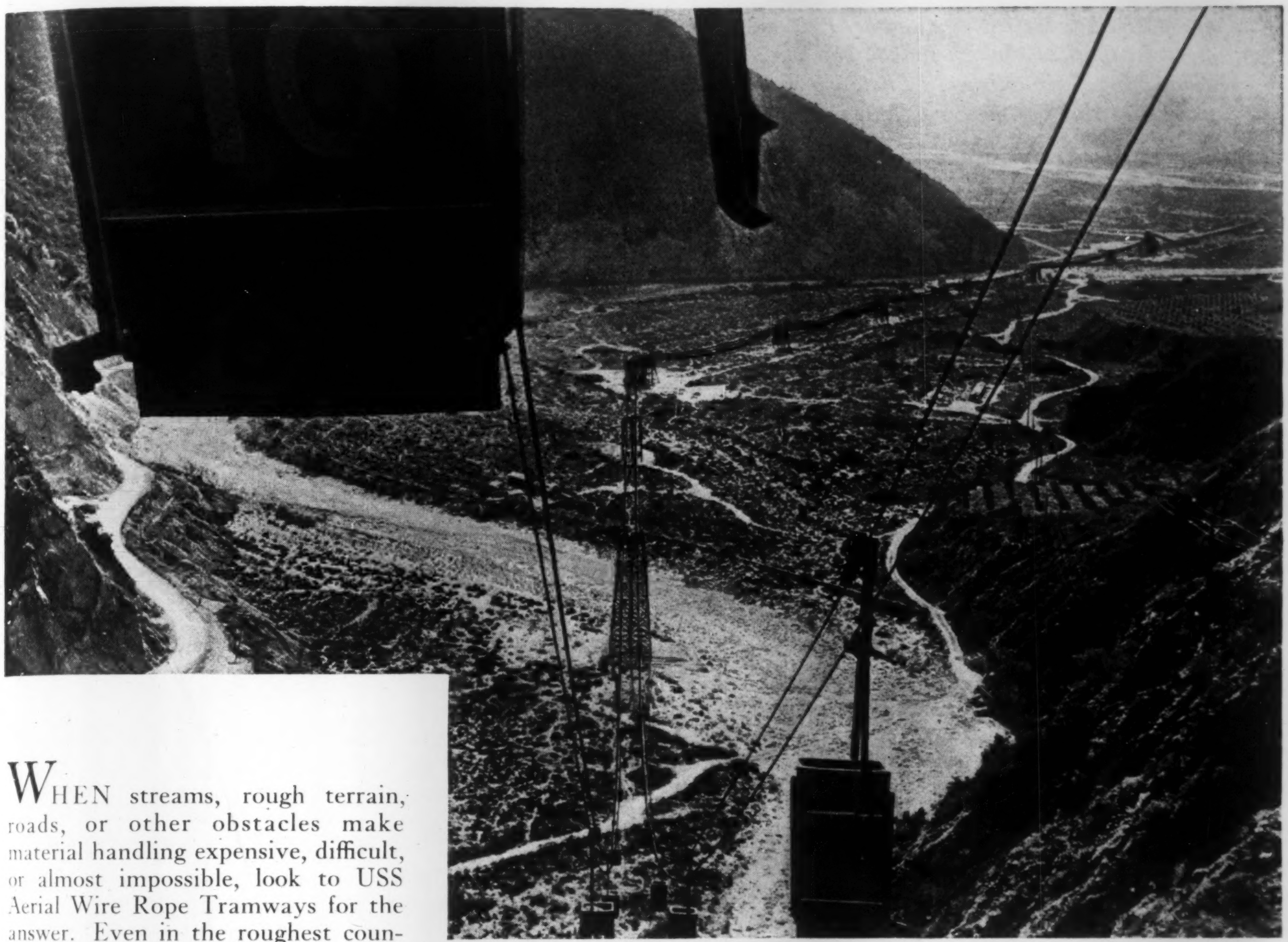

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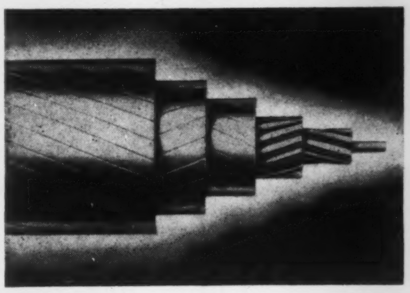

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UNITED STATES STEEL

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BRIDGES

Bascule, Chicago, Ill. Record-Size Bascule. *Eng. News-Rec.*, vol. 118, no. 16, Apr. 22, 1937, pp. 583–587. Design and construction of double-leaf bascule bridge at Outer Drive crossing of Chicago River, 264 ft between trunnions and 108 ft wide, intended for double-deck service; foundations; machinery for bridge operation; lock details at center and rear of leaves.

Concrete Arch, Germany. Die Pfannlochbruecke und die Hoellenbachbruecke an der Deutschen Alpenstrasse, H. Olsen. *Bautechnik*, vol. 14, nos. 43 and 44, Oct. 2, 1936, pp. 638–642, and Oct. 9, pp. 651–654. Design and construction of two multiple-arch reinforced-concrete bridges on Alpine highway of Germany: (1) Pfannloch Bridge, 3 arches, 18.7 to 19.5 m long; (2) Hoellenbach Bridge, 3 arched spans of curved alignment, maximum span 32.4 m. Roadway in both cases is 9 m wide.

Concrete Girder, Germany. Die neuere Entwicklung des Baues weitgespannter Eisenbetonbalkenbruecken in Deutschland, L. Pistor. *Bautechnik*, vol. 14, no. 43, Oct. 2, 1936, pp. 630–635. Review of recent construction of long-span concrete girder bridges as exemplified by 12 bridges, with spans up to 62 m in length, built in various parts of Germany, during period from 1933 to 1935, inclusive; typical cross sections and profiles of girders; steel reinforcement; concrete placing. Bibliography.

Concrete, Italy. Le realizzazioni del Regime nella Maremma Toscana, M. Tognozzi. *Annali dei Lavori Pubblici*, vol. 75, no. 2, Feb. 1937, pp. 137–147. Description of several highway bridges of moderate span, including concrete arch and concrete girder types, built in Maremma Toscana reclamation project in Italy.

Construction, Accidents. Golden Gate Bridge Scaffold. *Eng. News-Rec.*, vol. 118, no. 16, Apr. 22, 1937, p. 590. Study of accident of March 1937 leading to conclusion that hangers failed through overstress of aluminum side castings; results of hanger tests.

Floors. Integral Combinations of Structural Timber and Cement Concrete in Composite Construction, J. F. Seiler. *La. Eng. Soc.*—Proc., vol. 22, no. 3, June 1936, pp. 157–178, (discussion) 178–180. Development of composite timber concrete beams or slabs for highway bridge decks; Oregon's contribution to development of this construction; results of laboratory and field tests.

Floors, Germany. Stahlbruecken mit Leichtfahrbahnen, K. Schaechterle and F. Leonhardt. *Bautechnik*, vol. 14, nos. 43 and 45, Oct. 2, 1936, pp. 626–630, and Oct. 16, pp. 659–662. Results of tests of light-weight floors for steel bridges, using reinforced sheet steel on bottom surface of girder; examples from German practice.

Highway, Design. Die Beruecksichtigung der Dauerbeanspruchung bei der Berechnung und Durchbildung geschweisster Strassenbruecken, H. Casper. *Bautechnik*, vol. 14, no. 43, Oct. 2, 1936, pp. 622–626. Review of methods of design of welded steel girders of highway bridges, taking into account fatigue stresses induced by vehicles whose weights are only small fraction of maximum allowable load but are exceedingly variable as to intensity and location.

Steel, Design. Die Stabilitaet der Brueckenendrahmen, A. Hertwig and K. Pohl. *Stahlbau* (supp. to *Bautechnik*), vol. 9, no. 17, Aug. 14, 1936, pp. 129–130. Discussion of function of end portals of steel bridges; derivation of buckling formula; numerical examples.

Steel Truss, Pre-Stressing. Pre-Stressing Bridge Girders, H. J. Nichols. *Instn. Civ. Engrs.—J.*, no. 4, Feb. 1937, pp. 91–137 (discussion), 138–160, 3 supp. sheets. Methods and equipment use in pre-stressing of steel trusses, 282 ft in span, of railroad bridge over Nerbudda River at Broach, India; results of model tests; primary, deformation, and secondary stresses; proposed modifications for pre-stressing.

Steel, Welding. Arc-Welded Bridges—A Survey, A. R. Moon. *Structural Engr.*, vol. 14 (new series), no. 8, Aug. 1936, pp. 335–350. Review of recent European practice in welding of steel girder bridges, portal frame girders, and arch bridges; site welding. Bibliography. Before Instn. Structural Engrs.

BUILDINGS

Ancient. Preservation of Ancient Monuments, A. Heasman. *Structural Engr.*, vol. 14 (new series), no. 8, Aug. 1936, pp. 351–363. Outline of methods developed by British Office of Works for preservation of ancient abbey buildings and similar structures. Before Instn. Structural Engrs.

Ceramic Products. Super-Ceramic Building Members, F. O. Anderegg. *Am. Cer. Soc.—J.*, vol. 20, no. 3, Mar. 1937, pp. 77–79. Strength of ceramic masonry units; limitations of use; effect of pre-pressing, analysis of pre-pressing, and loading operations using celluloid models and polarized light.

Doors, Fire Retardant. Report of Committee on Protection of Openings in Walls and Partitions. *Nat. Fire Protection Assn.—Advance Publ. Mtg.*, May 10–14, 1937, 8 pp. Amendments to regulations pertaining to counterbalanced doors, doors oversize for standard fire protection, types of doors, masonry at wall openings, wall frames, tin-clad fire doors, sheet metal doors, and swinging hollow metal doors.

Roofs, Concrete. Hollow Concrete Rigid Frames Support Auditorium Roof, W. T. Wright. *Eng. News-Rec.*, vol. 118, no. 15, Apr. 15, 1937, pp. 560–562. Design and construction of hollow girder roof recently built for auditorium at Bradford Avenue School in Placentia, Calif.; girders and supporting columns, which also are hollow, form series of five rigid frame bents 26 ft high, spaced about 18 ft apart; span is 77 ft, and floor plan of auditorium is 77 by 127 ft; column details.

Steel, Welded. Arc Welding in Building Construction, C. H. Jennings. *Welding Engr.*, vol. 22, no. 4, Apr. 1937, pp. 19–21. Two all-welded buildings, fabricated for Westinghouse Electric & Manufacturing Co., described; they illustrate application of welding to multiple-story buildings and single-story extensions to old buildings.

Towers, Scaffolding. Steel Scaffolding, P. M. Andrews. *Structural Engr.*, vol. 14 (new series), no. 12, Dec. 1936, pp. 490–505. Details of steel pipe scaffolding developed in England for construction and maintenance work on towers and similar structures. Before Instn. Structural Engrs.

CITY AND REGIONAL PLANNING

Chicago, Ill. Lakefront Boulevard Link Forms Milestone in Chicago Plan, H. E. Young. *Eng. News-Rec.*, vol. 118, no. 15, Apr. 15, 1937, pp. 546–548. Joining of park systems on north and south sides of Chicago River by bridge and viaduct completing continuity of lakefront facilities; economic justification; future extensions.

Municipal Engineering, United States. City Engineering Issue. *Eng. News-Rec.*, vol. 118, no. 17, Apr. 29, 1937, pp. 613–643. Symposium on progress of municipal engineering in United States include following: To Build Better Cities; Back from Depression, C. W. Ham; Job Ahead, R. N. Towl; Focusing on Finance, F. L. Bird; Building to a Program, J. P. Schwada; New Streets for Old, G. B. Sowers and M. S. Douglas; Street Maintenance, W. B. Shafer; Water Supply and Sanitation, S. A. Greeley; Guiding City Growth, R. Kingery; City Engineer Today, L. D. Gayton; Organization and Personnel, E. P. Goodrich.

CONCRETE

Cement Admixtures, Arsenic. Arsenic Cement, G. Smitt and P. Palén. *Permanent Int. Assn. of Navigation Congresses—Bul.*, vol. 11, no. 21, Jan. 1936, pp. 93–102. Report on satisfactory experience of Swedish Academy of Engineering Science in use of arsenous oxide as admixture to portland cement for protection of piles and hydraulic structures against deterioration in water.

Construction. Some Comparisons of European and American Concrete Practice, F. R. McMillan. *Am. Concrete Inst.—J.*, vol. 8, no. 4, March–April 1937, pp. 395–410. Comparative review of recent concrete structures and construction methods observed in Europe during 10-week study trip.

Construction, Precasts. Mopin System of Construction. *Concrete & Constr. Eng.*, vol. 31, no. 10, Oct. 1936, pp. 557–563. Outline of system invented by E. Mopin, of which principal features are light structural framework of steel units with interchangeable precast vibrated concrete floors, walls, partitions, staircases, etc.; use of system in construction of housing projects in Paris suburbs; effects of consistency of concrete; manufacture by immediate removal of molds; rate of output; concrete materials; period of vibration; advantages of system.

Construction, Prestressing. Developments in Concrete Making, E. Freyssinet. *Concrete & Constr. Eng.*, vol. 31, no. 4, Apr. 1936, pp. 209–220. Outline of author's process giving more than 5,000 lb per sq in. 2 hours after mixing, by pre-stressing of high-grade reinforcement, vibrating, and compressing of concrete; practical use of pre-stressing; use in strengthening of foundations; manufacture of piles and bridge girders.

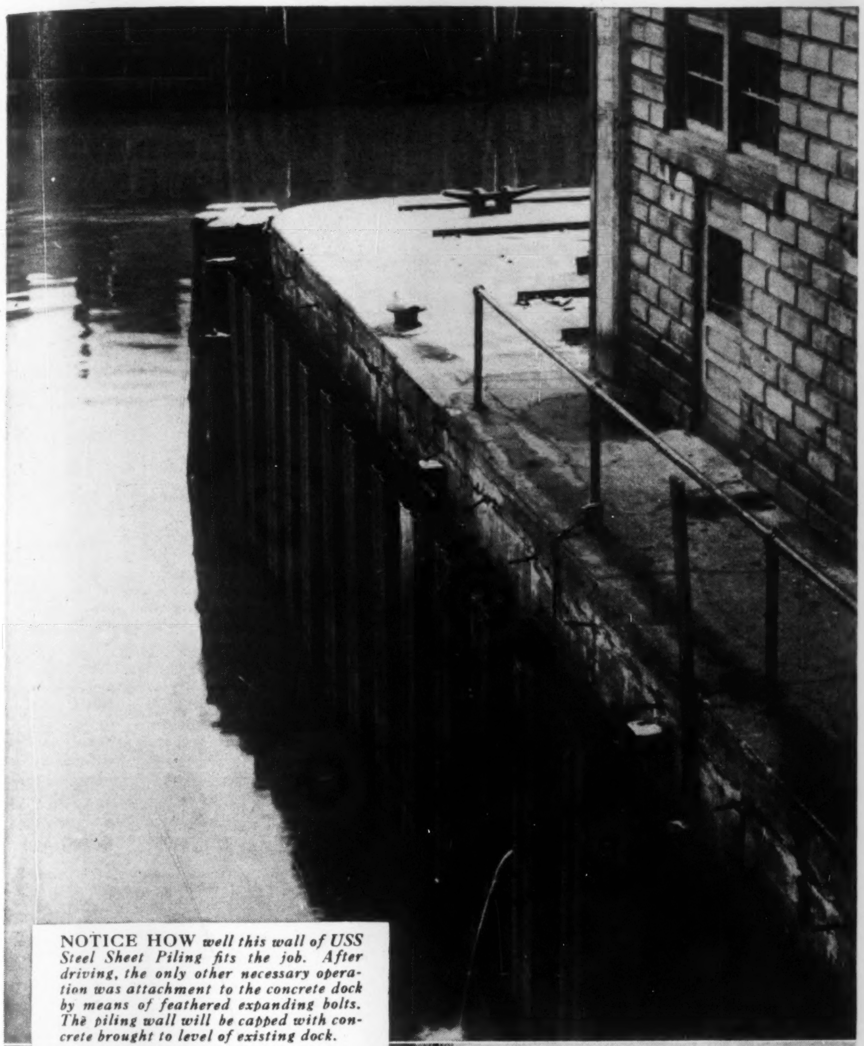
Construction Research. Fundamental Research on Application of Vibration to Pre-Casting of Concrete, D. A. Stewart. *Surveyor*, vol. 91, no. 2351, Feb. 12, 1937, p. 282. Factors influencing redistribution of particles; results of tests on initial settlement, redistribution, and stabilization. Before Instn. Civ. Engrs.

Design. Design of Reinforced Concrete Members Under Flexure or Combined Flexure and Direct Compression, C. S. Whitney. *Am. Concrete Inst.—J.*, vol. 8, no. 4, March–April 1937, pp. 483–498. Outline of revised method of designing reinforced concrete members subjected to bending; rational method for proportioning of arch ribs, rectangular columns under eccentric load, and rectangular beams; design of I-beams, round columns, and any other form of concrete members. Bibliography.

CONSTRUCTION INDUSTRY

Costs. Current Construction Unit Prices. *Eng. News-Rec.*, vol. 118, no. 14, Apr. 8, 1937, pp. 539–540. Unit costs bid on construction of railroad facilities, San Francisco–Oakland Bay Bridge; Kentucky River Bridge, Frankfort, Ky. (1,652 ft long); Sardis hydraulic-fill dam in northern Mississippi (96 ft high); Southbridge, Mass., dam and reservoir; shafts for Delaware River aqueduct.

HOW TO SOLVE A PROBLEM CAUSED BY *Lower Lake Levels*



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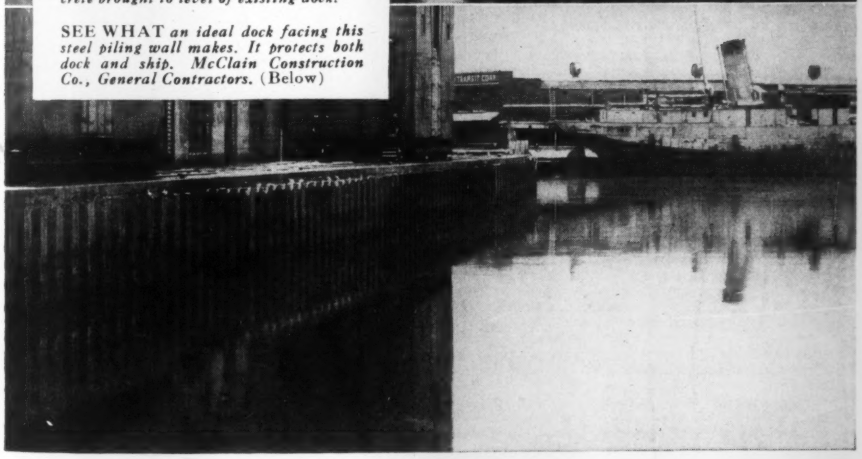

IN recent years, lower water levels of several of the Great Lakes have become a serious problem.

In addition to lowering the available draft along docksides, this lower water level is exposing the tops of wood bearing piles — endangering the support of many valuable piers and docks.

The experience of Spencer Kellog and Sons, Inc., will be of interest to other owners facing similar problems. The water in the boat slip adjacent to their elevator dock in Buffalo dropped so far that the tops of the wood bearing piles became exposed to alternate wetting and drying. These vital supports began to deteriorate. Something had to be done.

They found that USS Steel Sheet Piling would solve this problem quickly, effectively, and at low cost. They simply had the two sides of their dock faced with a continuous wall of MZ-32, one of our recently developed, highly efficient "Z" sections. Back of this wall, they piled a wet fill which will protect the original wood bearing piles.

This wall of steel sheet piling not only retains the wet mud fill; it also will permit dredging for deeper draft on the water side.

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UNITED STATES STEEL

DAMS

Boulder Dam Project. Boulder Dam Power Development, W. W. Lewis. *Mines Mag.*, vol. 27, no. 4, Apr. 1937, pp. 8–13 and 15. General description of electric equipment of power house; water supply for generators; operation of power plant. Bibliography.

Concrete Arch. Baustoffersparnis durch Verwendung von Bogengewichtsund Bogenstaumauern, F. Toelke. *Bauingenieur*, vol. 18, nos. 1/2, Jan. 8, 1937, pp. 11–20. Theoretical mathematical discussion of economy of concrete arch dams, including curved gravity type, illustrated by American and Italian examples.

Concrete, Construction. Special Panel Form Staging, D. McFarland. *Eng. News-Rec.*, vol. 118, no. 14, Apr. 8, 1937, p. 524. Details of staging for work on concrete forms, which can be hung up against forms when not in use, employed in construction of Grand Coulee Dam.

Earth. Construction of Cheddar Reservoir, R. W. Hall. *Instn. Water Engrs.—Trans.*, vol. 41, 1936, pp. 27–47, (discussion) 47–51. Construction of clay puddle earth-fill dam, 44 ft maximum height, with cut-off trench averaging 36 ft in depth; details of apparatus for testing clay puddle.

Earth, Great Britian. Talybont Reservoir Scheme, W. W. Marsden. *Instn. Water Engrs.—Trans.*, vol. 41, 1936, p. 1–6 (at end). Construction of clay puddle earth dam, 97 ft maximum height, 1,400 ft long.

Earth, Stability. Beitrag zur Berechnung der Standsicherheit von Erddaemmen, E. Meyer-Peter, H. Favre, and R. Mueller. *Schweizerische Bauzeitung*, vol. 108, no. 4, July 25, 1936, pp. 35–37. Theoretical mathematical discussion of stability of earth dams; percolation of water through body of earth dams; analysis of internal stresses.

Foundations. Art of Pressure Grouting, V. L. Minear. *Reclamation Era*, vol. 27, no. 3, Mar. 1937, pp. 56–59. Development of grouting practice in construction of Boulder Canyon Dam; rock grouting; grout crew; communication system; pressure washing.

Movable, Rollers. Le barrage de Ramet-Ivoz, G. Willems. *Ossature Métallique*, vol. 5, no. 11, Nov. 1936, pp. 494–502. Design and construction of steel roller dam, over Meuse River, at Ramet-Ivoz, Belgium, consisting of five 24-m spans, supporting maximum head of 7.35 m.

Reservoirs, Outlets. Freezing of Reservoir Outlets, A. G. Beaumont. *Instn. Water Engrs.—Trans.*, vol. 41, 1936, pp. 73–75, (discussion) 75–80. Detailed report on freezing up of tunnel grating at depth of 30 ft in Ringstone reservoir of Wakefield Corporation, England.

Rock Fill, China. Shing Mun Dam, Hong Kong. *Engineer*, vol. 163, no. 4228, Jan. 22, 1937, pp. 98–102 and 106. Illustrated description of dam, which consists of five parts and is constructed of concrete with cement content of only 300 lb per cu yd; details of diversion and overflow tunnels; water supply tower and conduit construction of dam.

Welding. Welding on Fort Peck Dam Project, W. M. Galloway. *Welding J.* (N.Y.), Vol. 16, no. 4, Apr 1937, p. 19. Some of high lights of welding work being carried on in this district pointed out.

FLOOD CONTROL

United States. Floods in United States of America. *Engineering*, vol. 143, nos. 3709 and 3710, Feb. 12, 1937, pp. 182–184, and Feb. 19, pp. 213–214. Review of certain relatively recent occurrences; cyclonic disturbances; New York State flood of July 1935.

FOUNDATIONS

Cofferdams, Failure. Serious Leak Checked in Cofferdam at Grand Coulee. *Eng. News-Rec.* vol. 118, no. 16, Apr. 22, 1937, pp. 595–597. Report on collapse of one cell of cofferdam caused by softening of base due to flow through deep sand stratum; method of repair.

Soils, Physics. Porenziffer und Porenwasserdruck in Tonen, L. Rendulic. *Bauingenieur*, vol. 17, nos. 51/53, Dec. 25, 1936, pp. 559–564. Theoretical mathematical discussion of flow of capillary moisture in clays, due to changes in loads on clay; further extension of Terzaghi's theory of hydrodynamic stresses in soils; relation between porosity coefficient and conditions of stress.

Stresses. Conditions de stabilité du sol, Buisson. *Travaux*, vol. 20, no. 48, Dec. 1936, pp. 570–576. Theoretical discussion of stability of soils and conditions of failure of foundation ground; case of pervious and impervious soils; predicting subsidence of foundations; theory of elastic core; effect of depth of soil. Bibliography.

Testing. Foundation Exploration with 36-Inch Drills. *Reclamation Era*, vol. 27, no. 3, Mar. 1937, pp. 60–61 and 64. Experience of U. S. Bureau of Reclamation with large-diameter drilling for exploration of dam sites; man-hours and cost data.

Testing, Progress. Fortschritte auf dem Gebiet der Baugrundforschung, W. Loos. *VDI-Zeit*, vol. 81, no. 13, Mar. 27, 1937, pp. 381–384. Recent progress in field of foundation research as discussed at International Conferences of Soil Mechanics and Foundations; symposium of abstracts on research studies and applications of results obtained in various countries.

HYDROLOGY AND METEOROLOGY

Earthquakes. Variation of Magnetic Dip in Central Japan, S. I. Hakamura and Y. Kato. *Tohoku Imperial Univ.—Science Reports—K. Honda Anniversary Volume*, Oct. 1936, pp. 181–192. Results of systematic observations since September 1934; soon after first observation, it was found that anomalous state of disturbance in terrestrial magnetic field prevailed over certain area in Osaka; as disturbance was similar to that which took place before earthquake of March 3, 1933, authors succeeded in predicting this earthquake and taking precautionary measures. (In English.)

Japan. Correlational Method on Weather Forecasting, K. Shiratori. *Tohoku Imperial Univ.—Science Reports—K. Honda Anniversary Volume*, Oct. 1936, pp. 208–220. Calculation of correlational coefficients among successive variations of weather elements (atmospheric pressure and temperature) in different regions near Japan; some active groups of regions were found where correlational coefficients are large; using these coefficients, subsequent change in weather conditions in certain regions may be numerically estimated. (In English.)

IRRIGATION

Research. Report for Year Ending April 1936. Punjab Irrigation Research Institute. Lahore Government Printing, Punjab, 1936. 73 pp., figs., diagrs., charts, tables, supp. sheets. Annual report on irrigation research in Punjab, India, including brief summaries of studies on effect of irrigation water on soils, uplift pressures under weirs, model testing of irrigation works, rise of water table, management of irrigated lands, etc.

Texas. Modern Rice-Irrigation System, W. B. Gregory. *Mech. Eng.*, vol. 59, no. 5, May 1937, pp. 359–360. Description of recent development in Orange County, southeastern Texas, and tests that were made of Diesel-driven screw pumps provided for that project; canals and flumes for supplying water. Before Am. Soc. Mech. Engrs.

MATERIALS TESTING

Beams, Continuous. Versuche zur weiteren Klaerung der Frage der tatsaechlichen Tragfaehigkeit durchlaufender Traeger aus Baustahl, Maier-Leibnitz. *Stahlbau* (supp. to *Bautechnik*), vol. 9, no. 20, Sept. 25, 1936, pp. 153–160. Discussion of results of tests of 3-span continuous structural steel I-beams, 6 m long, made at laboratory of Stuttgart Institute of Technology; mathematical discussion of results.

Plasticity. Grundsaetzliches zur Plastizitaetstheorie, J. Fritsche. *Stahlbau* (supp. to *Bautechnik*), vol. 9, no. 9, Apr. 24, 1936, pp. 65–68. Theoretical mathematical discussion of fundamentals of theory of plasticity and its application in structural design.

Stresses. Transverse Elasticity of Building Materials, R. H. Evans and R. H. Tood. *Engineering*, vol. 143, no. 3708, Feb. 5, 1937, pp. 161–163. Results of experimental investigation of transverse strains in materials in both tension and compression; tests made on columns of concrete, sandstone, slate, granite, marble, and ebonite, equivalent gage length being usually 90 in. Before Brit. Assn.

PORTS AND MARITIME STRUCTURES

Brownsville, Tex. Brownsville Port Development, C. J. Howard. *Eng. News-Rec.*, vol. 118, no. 15, Apr. 15, 1937, pp. 556–559. Review of recent large-scale construction in port of Brownsville, Tex., including channel for deep-draft vessels—cut extends 18 miles from Gulf of Mexico to large turning basin where wharves and other port facilities have been built; concrete wharf; truck and rail connections; oil dock; cost of port facilities.

Dover. Dover Train Ferry. *Concrete & Constr. Eng.*, vol. 31, no. 11, Nov. 1936, pp. 614–617. Construction of terminal of ferry across English Channel; constructing ferry slip having internal length of 414 ft, a width of 70 ft, and depth of water of 17 ft; details of pumping plant having capacity of 120,000 gal per min, also dock walls 28 ft thick.

Dredging. Maintenance of Waterways to Harbors and Docks, R. Carpmael. *Instn. Civ. Engrs.—J.*, no. 3, Jan. 1937, pp. 423–447, (discussion) pp. 448–468. Causes of siltation; methods employed to maintain waterways; historical survey of dredging craft; types of dredging craft; docks organization; statistics of dock and channel dredging; modernization and centralization of Great Western Railway fleet of dredges.

Port Arthur, Tex. Safety Measures Are Widely Employed at Gulf Docks, K. S. Moss. *Oil & Gas J.*, vol. 35, no. 43, Mar. 11, 1937, p. 61. Description of emergency alarm system on 3,000-ft concrete wharf at Port Arthur, Tex., refinery of Gulf Refining Corporation; loading arrangements provide for servicing nine ships simultaneously; in case of threatened fire or overflow, deck man or dock foreman throws switch lever, and relays shut down all electrically powered pumps and sound warning gongs; cargo loading cannot be continued until orders are received from dockmaster.

ROADS AND STREETS

Construction, Minneapolis. Day-Labor Street Paving, E. F. Campbell. *Eng. News-Rec.*, vol. 18, no. 12, Mar. 25, 1937, pp. 437–439. Outline of system of street paving by means of day labor, practiced in Minneapolis for 35 years; financing plans; laboratory control of all materials for Minneapolis street work; main items of current equipment for pavement construction; equipment and plant; merits of day labor.

Highway Administration. Highway Administration and Construction Problems, T. H. MacDonald. *Roads & Streets*, vol. 80, no. 3, Mar. 1937, pp. 52, 54, 56, and 58. Trends that have major influence on highway-improvement program; selection of skilled labor; classification of labor on works-program projects; established wage rates; grade-crossing elimination program; federal aid.

Highway Systems, Denmark. Un grandioso progetto di autostrada in Danimarca, A. Tarantini. *Annali dei Lavori Pubblici*, vol. 75, no. 1, Jan. 1937, pp. 1–12. Review of recent development of Danish highways, including some very long steel-truss and steel-arch highway bridges connecting islands and mainland.

Highway Systems, Ohio. Report on Plan of Main Thoroughfares for Hamilton County, Ohio. Regional Planning Commission, 1936. 126 pp., charts, tables, maps, supp. sheets. Planning of highway system of county occupying area of 407 sq miles, having population of about 600,000, including city of Cincinnati; major traffic arteries and physiographical features; principles of design of main thoroughfare plan; principal diagonal and circumferential routes; traffic lane capacities recommended; thoroughfare improvement program; tabulation of traffic flow and capacity, 1931 and 1935.

Machinery, Germany. Geraete fuer den maschinellen Strassenbau, F. Riedig. *Bautechnik*, vol. 14, no. 40, Sept. 11, 1936, pp. 595–598. Review of recently introduced German methods of excavating, compacting, concreting, and vibrating equipment for road construction.

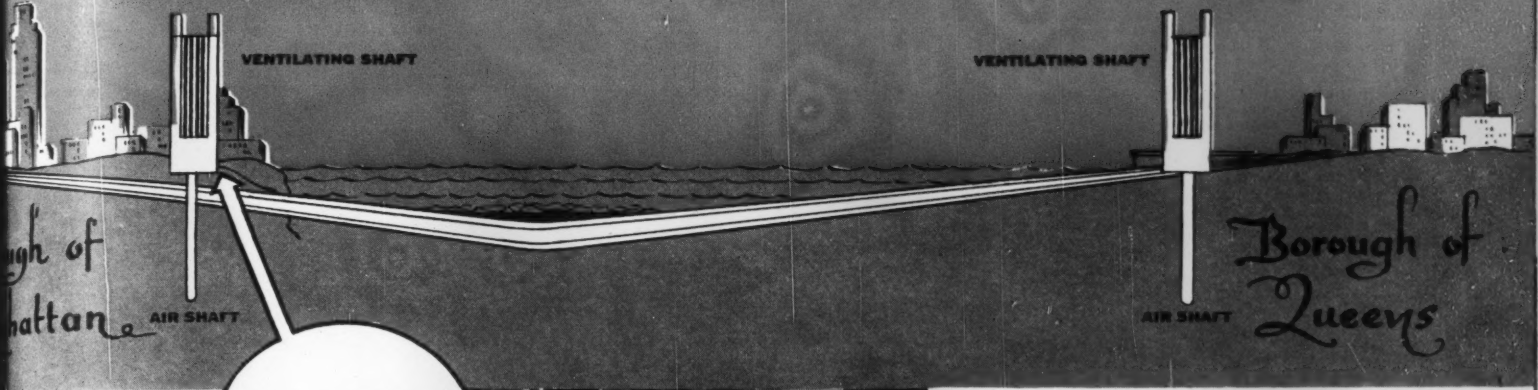
Maintenance and Repair. High-Speed Street Rehabilitation, J. W. Cleveland. *Military Engr.*, vol. 29, no. 164, Mar.-Apr., 1937, pp. 114–116. Plans, specifications, and construction methods used for resurfacing 25 miles of streets in Evanston, Ill.

Maintenance and Repair, Missouri. Modernizing Old Concrete Road with Maximum Salvage, V. B. Saville. *Eng. News-Rec.*, vol. 118, no. 14, Apr. 8, 1937, pp. 515–519. Recent resurfacing operations by Missouri State Highway Department; badly broken old pavement made to give limit of reservice by widening and resurfacing; both asphalt and concrete topping were successfully employed; asphaltic concrete and cement concrete resurfacing; typical asphalt mixes used in resurfacing and widening old concrete pavement; expansion joints and center joints for concrete resurfacing.

Materials, Bituminous. Recent Developments in Bituminous Road Materials, G. E. Eckert and H. F. Winterkorn. *Roads & Streets*, vol. 80, no. 3, Mar. 1937, pp. 43–48. Review of patent literature for 1931 to 1936, covering modification by chemical means, improvement by addition of organic materials, blending, cutting, emulsions, mineral fillers, pre-treatment of aggregates, mixing, and application. Bibliography.

Omaha, Nebr. Superstreet Design in Omaha, H. Trustin. *Eng. News-Rec.*, vol. 118, no. 16, Apr. 22, 1937, pp. 592–595. Modernization and repavement of arterial streets in Omaha, Nebr., to provide for interstate traffic access and dispersion; heavy pavement varied to suit service requirements; pavement crown modified; new bridge outlets.

Again DU PONT *starts* ANOTHER FAMOUS PROJECT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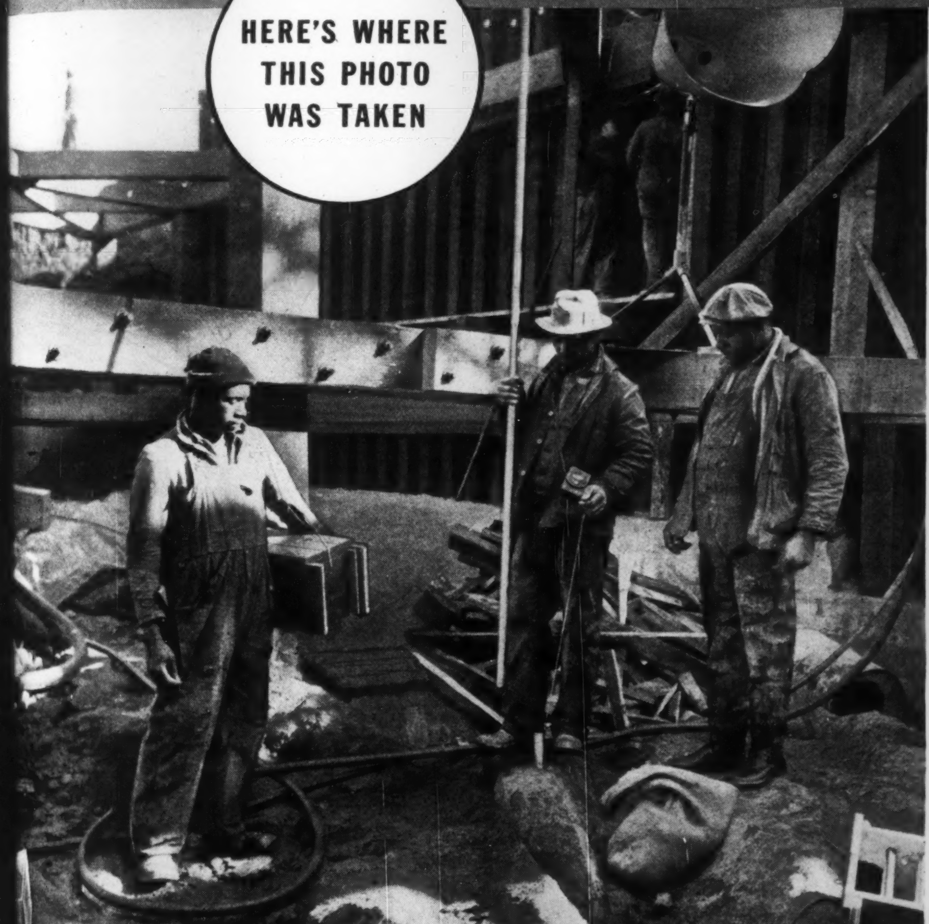
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Railroad Crossings, Elimination. Federal Grade Crossing Program Is in Full Swing. *Ry. Age*, vol. 102, no. 11, Mar. 13, 1937, pp. 425–429. Government programs for expenditure of $200,000,000; total of 3,008 projects approved; 854 separations and 108 signal protection projects completed as of Feb. 28, 1937; progress during last 6 months.

Railroad Crossings, Specifications. Report of Committee IX—Highways. *Am. Ry. Eng. Assn.—Bul.*, vol. 38, no. 391, Nov. 1936, pp. 255–272. Revision of manual, 90-deg, sheet-steel crossing sign assembly for suspension over highway and details; designs and specifications for highway crossings at grade over railway tracks, both steam and electric; "gates-not-working" and "watchmen-not-on-duty" signs; barrier type of grade-crossing protection, including automatic gates; outline of complete field of work of Committee.

Roadside Improvement. Roadside Development for Counties—III and IV, F. M. Guirey. *Pub. Works*, vol. 68, nos. 2 and 3, Feb. 1937, pp. 21–22, and Mar., pp. 24–26. Tree planting on county highways; proper location of trees and kinds to plant. Organization, planning, and cost of roadside development for counties.

Roadside Improvement, Methods. Artistic Roadways, W. B. Edwards. *Surveyor*, vol. 91, no. 2351, Feb. 12, 1937, pp. 285–6. Suggestions of numerous methods for improving roadsides.

Stabilization. Fighting Subgrade Swelling on Kansas Roads. *Eng. News-Rec.*, vol. 118, no. 11, Mar. 18, 1937, pp. 405–409. Symposium on laboratory tests and field correction of subgrade swelling of concrete roads, consisting of following: Absorptive Soils Cause Heaving, H. D. Barnes; Field Method of Stabilization, H. Allen; Verification Sought from Test Road, H. D. Barnes and H. Allen.

Stabilization, Costs and Methods. Methods and Costs of Road Stabilization in Minnesota, L. L. Allen. *Roads & Streets*, vol. 80, no. 3, Mar. 1937, pp. 63–64, 66, and 68. Classification of stabilized road types; laboratory tests of soil material; determination of plasticity index; methods of pulverization and compaction; importance of crown; costs of gravel-base projects completed in 1936.

Switzerland. Swiss Methods in Concrete Road Construction, H. S. L. Knight. *Surveyor*, vol. 91, no. 2350, Feb. 5, 1937, pp. 239–240. Rapidly extending use of concrete; typical construction job described.

SEWAGE AND SEWAGE DISPOSAL

Industrial Waste. Report on Sanitary Engineering Projects Year 1936, E. F. Eldridge and F. R. Theroux. *Mich. Eng. Experiment Station—Bul.*, no. 71, vol. 12, no. 3, Nov. 1936, 55 pp., 25 cents. Beet Sugar Factory Waste Treatment, E. F. Eldridge; Spray Drying of Steffens Waste, E. F. Eldridge and F. R. Therous; Design and Operating Results of Typical Milk Waste Filter, E. F. Eldridge.

Modern Methods. Sewerage Engineering, W. E. Bush. *Instn. Engrs. Australia—J.*, vol. 8, no. 11, Nov. 1936, pp. 435–438. Modern tendencies in design; sewer velocities; ventilation of sewers; house drainage; sewage disposal; conservancy; dilution or direct discharge into fresh or salt water; land treatment; chemical treatment; simple sedimentation; bacteriological or biological treatment; activated sludge process; trade wastes.

Plants, Germany. Die Erweiterungsbauten der Stuttgarter Hauptklaeranlage, etc, Maier and Sohler. *Gesundheits-Ingenieur*, vol. 59, nos. 48 and 49, Nov. 28, 1936, pp. 703–709, and Dec. 5, pp. 718–724. Description of new sedimentation reservoirs, sludge tanks, sludge pumps, and other structures and equipment of new extension of main sewage disposal plant of Stuttgart, built during 1935 and 1936; heating and gas recovery plants; operating experience; construction cost data.

Plants, Orrville, Ohio. Sewage Treatment Designed to Handle Industry's Wastes, C. C. Hommon. *Water Works & Sewerage*, vol. 84, no. 2, Feb. 1937, pp. 64–66. Sewage and industrial waste disposal methods in town of 4,400 population. Before Ohio Conference on Sewage Treatment.

Plants, St. Charles, Ill. Performance Bond Covers St. Charles Works, C. W. Klassen. *Mun. Sanitation*, vol. 8, no. 3, Mar. 1937, pp. 172–175. Putnam process of treatment utilized in sewage treatment plant at St. Charles, Ill., constructed on basis of performance bond for community of 5,377 inhabitants.

Plants, Washington, D.C. Sewage Disposal for Nation's Capital, F. A. Marston. *Eng. News-Rec.*, vol. 118, no. 12, Mar. 25, 1937, pp. 431–436. Design and construction of primary sewage treatment and sludge digestion plant for District of Columbia; capacity of 130 mgd; treatment recommendations; pumping station details; grease separation by air; circular sedimentation tanks; sludge digestion tanks; elutriation of sludge; sludge conditioning; vacuum filter units.

Sewers. Template Guides Submarine Trench Excavation. *Eng. News-Rec.*, vol. 118, no. 15, Apr. 15, 1937, p. 551. Placement of reinforced concrete pipe with inside diameter of 5 ft, in trench, on ocean bottom, for outfall sewer for Los Angeles County Sanitation Districts; submarine template, fastened to and projecting from pipe section last laid, used in rock trench by diver to check grade and clearance on sides.

Sewers, Concrete. Severe Damage to Outfall Sewer Caused by Action of Acids. *Eng. News-Rec.*, vol. 118, no. 14, Apr. 8, 1937, pp. 519–520. Observations, for 14-year period, of disintegration of north outfall sewer in Los Angeles, showing much of cement mortar destroyed, spalling of tile liners, and some cracking.

Sewers, Design. Economic Advantages of Utilization of Hydraulic Head in Drop Manholes of Stormwater Sewer Systems, W. Nicoll. *Instn. Engrs. Australia—J.*, vol. 8, no. 11, Nov. 1936, pp. 430–432. Savings possible through utilization of manhole head in design; reductions in sewer sizes; maximum allowable velocities in stormwater sewers; culvert formula.

Sewers, Inspection. Down to Sea by Sewer—How It Was Done and What Was Found, R. F. Brown. *Western City*, vol. 12, no. 12, Dec. 1936, pp. 13–15 and 34. Results of visual and photographic inspection of north outfall sewer of Los Angeles, 10.5 ft high, 12.2 ft wide, 50 miles long construction of specially designed boat, 9 ft long with 32-in. beam, equipped with removable air tanks; illumination for inspection; gas conditions.

Sewers, Outfall. Large Sewer on Ocean Bottom Has Joints of Novel Design. *Eng. News-Rec.*, vol. 118, no. 10, Mar. 11, 1937, pp. 369–373. Concrete pipe with metal joints developed by Los Angeles County for outfall one mile long and 5 ft in diameter; outer end 110 ft deep; pontoon placement method; joint design facilitating handling by divers; solving joint problem; placing enshore portions; pontoon operations.

Storm-Water. Separation and Treatment of Storm-Water Sewage, H. H. Stanbridge. *Surveyor*, vol. 91, nos. 2350 and 2351, Feb. 5, 1937, pp. 245–257, and (discussion) Feb. 12, pp. 279–281. Interest in problem and means for handling it. Before Inst. Sewage Purification.

Water Pollution, United States. Effect of Modern Sewage Treatment on Sources of Public Water Supplies, K. L. Mick. *Am. Water Works Assn.—J.*, vol. 29, no. 4, Apr. 1937, pp. 496–503. Extent of sewage treatment in United States; relation of sewage treatment to water purification; variations in concentration of bacteria; cost aspects.

STRUCTURAL ENGINEERING

Earthquake Effect. Earthquake Resisting Structures, E. R. Dye. *Montana State College—Eng. Experiment Station—Bul.*, no. 1, Jan. 1936, 45 pp. Theories of design to resist earthquakes; light wood-frame construction; reinforced concrete structures; structural steel-frame construction; solid brick masonry construction; chimneys; cost of construction for earthquake shocks; typical building code covering brick wall and chimney construction. Bibliography.

Floors, Concrete Slab. Die Versuchspilzdecke in Baku, M. Steuermann. *Beton u Eisen*, vol. 35, nos. 21 and 22, Nov. 5, 1936, pp. 357–363, and Nov. 20, pp. 374–376. Mathematical analysis of results of large-scale tests, at Baku, U.S.S.R., of experimental reinforced-concrete mushroom floor system; 300 sq m in area; supported on 16 columns; floor slab was subjected to water load of over 3-m head.

Retaining Walls, Pressure. Pressure of Sea-Sand Behind Wall, A. A. Fordham. *Concrete & Constr. Eng.*, vol. 31, no. 12, Dec. 1936, p. 674. Results of tests carried out by author in Engineering Department of University College of Swansea. Before Instn. Civ. Engrs.

Walls, Earthquake Resistance. Use of Structural Walls in Resisting Earthquake Forces, A. G. McKay. *Commonwealth Engr.*, vol. 23, no. 12, July 1, 1936, pp. 363–371. Principles of design of external walls, permanent partitions, elevator shafts, etc., to resist horizontal forces due to earthquakes; deflections due to bending; length of members and treatment of haunches; deflections due to shear; flexibility of floor; unsymmetrical resistance; tables of design data. Bibliography.

TUNNELS

Aqueducts. Concrete for Conduit Invert Placed Under Steel Slip-Front. *Eng. News-Rec.*, vol. 118, no. 15, Apr. 15, 1937, pp. 564–565. Construction of conduit sections of Los Angeles aqueduct, using invert placement equipment known as slip-form; motors advance form slowly over prepared subgrade, at same time forcing down concrete fed through open-bottom trough along forward edge of form.

Construction. Collapsible Forms for Concrete Used in Flat-Arched Conduit. *Eng. News-Rec.*, vol. 118, no. 14, Apr. 8, 1937, pp. 520–521. Use of steel truss support designed to carry steel form panels, built up in sections and hinged, in construction of sludge pipe galleries beneath desilting plant at Imperial Dam.

Vehicular, Two Story. Su di un tipo di galleria urbana a due piani, E. Paolina. *Annali dei Lavori Pubblici*, vol. 75, no. 1, Jan. 1937, pp. 20–25. Discussion of proposed scheme for construction of two-story vehicular tunnel, lower story serving for vehicular and upper story for pedestrian traffic.

Water Supply, Concrete Lining. Belt Conveyor Jumbo Aids in Lining Small Tunnel. *Eng. News-Rec.*, vol. 118, no. 14, Apr. 8, 1937, p. 521. Use of jumbo, 75 ft long; receives cars containing aggregate or concrete and delivers contents, via conveyor belt, to concrete mixer, or to concrete placing machine, in construction of Mono Crater tunnel by Bureau of Water Works and Supply, City of Los Angeles.

Water Supply, Construction. Erfahrungen aus dem Druckstollenbau, H. F. Kocher-Preiswerk. *Schweizerische Bauzeitung*, vol. 108, nos. 8 and 9, Aug. 22, 1936, pp. 81–83, and Aug. 29, pp. 98–101. Author's technical experience and observations in connection with construction of large tunnels for hydroelectric power developments of Achensee project in Tyrol and Sernf project in Switzerland; concrete lining of power tunnels.

WATER PIPE LINES

Cross Connections. Quasi Public Water Supplies and Cross Connections with Municipal Water Supplies, A. H. Fletcher. *Am. Water Works Assn.—J.*, vol. 29, no. 1, Jan. 1937, pp. 78–85, (discussion) 85–88. Brief history and present status of problem; reasons for cross connections; summary of situation in Memphis. Bibliography.

Distribution Systems, Vacuum Breakers. Vacuum-Breaker Development for Back-Siphonage Prevention, F. M. Dawson and A. A. Kalinske. *Am. Water Works Assn.—J.*, vol. 29, no. 3, Mar. 1937, pp. 307–321. Review of means of protection against back-siphonage with resultant water pollution; conditions in water supply systems that vacuum-breaking devices must take care of; types of vacuum breakers available; testing of various protective devices; preventing back-siphonage by proper design and maintenance of water distributing systems.

Maintenance and Repair. Methods for Handling Emergency Main Repairs, H. E. Nunn. *Am. Water Works Assn.—J.*, vol. 29, no. 1, Jan. 1937, pp. 47–49. Review of practice of Van Buren, Ark.

Materials. Heimstoffe im Wasserleitungsbau, E. Naumann. *Gas- u Wasserfach*, vol. 79, no. 37, Sept. 12, 1936, pp. 674–677. Recent German experience with use of domestic materials in construction of water pipe lines and other water-works equipment, such as porcelain and glass for water filters, vitrified clay for pipe lines and pipe joints, aluminum and plastic materials for pipes, etc.

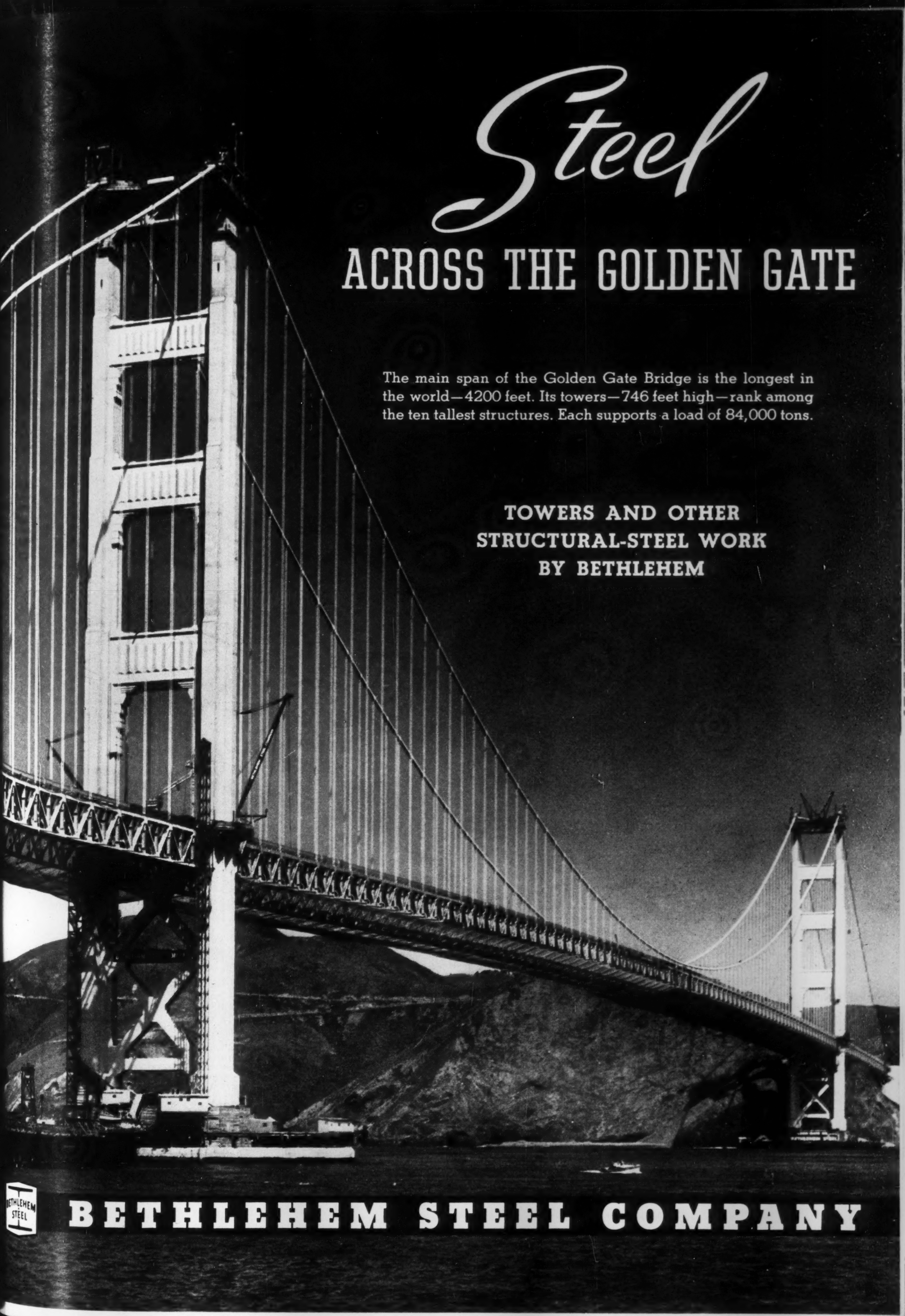
WATER RESOURCES

Underground, Minnesota. Artesian Water in Minnesota as Illustrated by Twin City Artesian Basin, G. M. Schwartz. *Am. Water Works Assn.—J.*, vol. 29, no. 4, Apr. 1937, pp. 489–495. Geology of Minnesota; Twin City artesian basin; requirements for artesian flow.

Water Law, Arizona. Ground-Water Law in Arizona and Neighboring States, G. W. P. Smith. *Univ. Ariz.—Agric. Experiment Station—Tech. Bul.*, no. 65, Dec. 29, 1936, pp. 47–91. Legislation with regard to use of water in Arizona; court decisions in Arizona; ground-water law in neighboring states; proposed uniform underground water law; special rules of law for ground-water rights.

WATER TREATMENT

Activated Alumina. Removal of Fluorides from Natural Waters by Defluorite, H. G. Swope and R. H. Hess. *Indus. & Eng. Chem.*, vol. 29, no. 4, Apr. 1937, pp. 424–426. Use of defluorite for removal of fluoride in water supply at Chetopa, Kans. Bibliography.



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ACTIVATED CARBON. Feeding of Powdered Activated Carbon, J. P. Harris and E. A. Sigworth. *Am. Water Works Assn.—J.*, vol. 29, no. 4, Apr. 1937, pp. 504–512. Review of characteristics of activated carbon affecting feeding arrangements for water treatment; early methods; dry feeding methods; fundamental rules; dustless method for emptying bags.

ACTIVATED CARBON, FILTERS. Granular Activated Carbon Filter Plant at Culver City, California, C. P. Harnish. *Am. Water Works Assn.—J.*, vol. 29, no. 1, Jan. 1937, pp. 66–71. Report on satisfactory experience with small experimental installation of activated carbon filters to eliminate taste and odor from underground water supply; cost data.

DRINKING WATER, FLUORIDE CONTENT. Fluoride in Ohio Water Supplies—Its Effect, Occurrence, and Reduction, R. D. Scott, A. E. Kimberly, A. L. Van Horn, L. F. Ey, and F. H. Waring. *Am. Water Works Assn.—J.*, vol. 29, no. 1, Jan. 1937, pp. 9–25. Toxic qualities of fluoride in water during period of tooth calcification; incidence of mottled enamel among school children; range in fluoride concentration; methods of analysis; fluoride removal by lime treatment and aluminum sulfate; rôle of magnesium; practical aspects and costs. Bibliography.

FILTRATION PLANTS, TOLEDO, OHIO. Experiments with Subsurface Filters at Toledo, Ohio, R. W. Furman. *Am. Water Works Assn.—J.*, vol. 29, no. 2, Feb. 1937, pp. 194–200. Operating experience at Toledo filtration plant, with experimental Jewell subsurface filtering and washing system consisting of two 10 by 10-in. manifold sections and 2-in. laterals connected to filter screens; method of washing; special sand studies; percentage relationship between sand and incrustation; change in washing methods.

IODINE. Gewinnung von Jod aus solches enthaltenden Waessern mittels Aktivkohle, F. Krczil. *Chemiker-Ztg.*, vol. 60, no. 97, Dec. 2, 1936, pp. 983–985. Recovery of iodine from well water by means of activated carbon; method consists in pretreatment of water, adsorption, and recovery of iodine.

LABORATORIES. Observations in Toronto Filtration Laboratories During Past 25 Years, N. J. Howard. *Am. Water Works Assn.—J.*, vol. 29, no. 2, Feb. 1937, pp. 173–187. Review of laboratory studies and observations recorded between years 1911 and 1935; problems associated with microscopic organisms; seasonal variations in efficiency; bacteriological observations; studies in coli-aerogenes group; chemical research; research in chlorination. Bibliography.

PLANTS, ONTARIO. New Pumping Station and Service Buildings, Toronto, Ont. *Can. Engr.*, vol. 72, no. 6, Feb. 9, 1937, pp. 7–9 and 12. Pumping plant, 295 ft long by 80 ft wide, equipped with two motor-driven 2-stage centrifugal pumps, each with capacity of 12,000,000 gal daily, against head of 191 ft and two other units, with capacity of 18,000,000 gal daily, against head of 260 ft.

RESERVOIRS. Treatment of Water in Reservoirs. *Water & Water Eng.*, vol. 38, no. 470, Nov. 1936, pp. 579–580. Description of specially designed craft for distributing chemicals, built recently by Thornycrofts to order of United Water Softeners, Ltd., to be used on Metropolitan Water Board reservoirs.

SOFTENING, IOWA. Water Softening at Glidden, Iowa, C. M. Stanley. *Am. Water Works Assn.—J.*, vol. 29, no. 4, Apr. 1937, pp. 469–474. Comparative study of efficiency and economy of lime treatment and zeolite treatment plant for community of 1,000; design and operation of zeolite treatment plant.

TASTE AND ODOR REMOVAL. Taste and Odor Problems at Kansas City, Kansas, L. B. Mangun. *Am. Water Works Assn.—J.*, vol. 29, no. 3, Mar. 1937, pp. 399–400. Use of activated carbon for removal of taste and odor occasionally occurring in water supply of Kansas City, Kans.

TASTE AND ODOR REMOVAL, IOWA. Taste and Odor Problems, W. T. Bailey. *Am. Water Works Assn.—J.*, vol. 29, no. 3, Mar. 1937, pp. 392–398. Experience of Water Department of Council Bluffs, Iowa, with taste and odor removal; removal of organic matter from raw water; stabilization of sludge in settling reservoirs; prevention of growth of algae in open reservoirs; prevention of bacterial aftergrowths in "dead ends" of distribution system; application of chlorine with addition of anhydrous ammonia. Bibliography.

TASTE AND ODOR REMOVAL, TESTS. Comparison of Odor Elimination Treatments, O. Gullans. *Am. Water Works Assn.—J.*, vol. 29, no. 1, Jan. 1937, pp. 60–65. Procedure for conducting odor tests; description of improved method for sensitive odor test; comparison of odor-elimination treatments on basis of hot odor threshold determinations before and after treatment. Bibliography.

TROPICS. Some Notes on Water Sterilization in Tropical Climate, J. S. Boissier. *Water & Water Eng.*, vol. 38, no. 470, Nov. 1936, pp. 573–578. Experience with treatment of waters of state of Perak, Malaya; local standards of wholesomeness; results of filtration; failure of chlorination; successful results of ammonia-chlorine treatment.

WATER WORKS ENGINEERING

ACCOUNTING. Water Works Accounting and Finance Practice, J. Schwartz. *Am. Water Works Assn.—J.*, vol. 29, no. 2, Feb. 1937, pp. 251–258. Discussion of major sets of records in waterworks organization; customers' accounts; storeroom and purchasing; fixed capital records; relationship of accountant and engineer; contract work; rate investigations; overhead; retirements; insurance; taxation; statistics.

BIBLIOGRAPHY. Information on Water and Sewage Problems—Where to Find It, L. H. Enslow. *Am. Water Works Assn.—J.*, vol. 29, no. 1, Jan. 1937, pp. 101–110. Lists of reference books and other sources of information for managers and operators of small and large water-works and sewage-disposal systems.

BIRMINGHAM, ALA. Industries Cooperate with City to Build Separate Water Supply. *Eng. News-Rec.*, vol. 118, no. 16, Apr. 22, 1937, p. 591. Progress report on construction of water supply system, for industrial purposes only, in Birmingham, Ala., estimated to cost $6,000,000.

COLD WEATHER OPERATION. Lessons from Winter of 1935–1936, W. C. Mabee. *Am. Water Works Assn.—J.*, vol. 29, no. 1, Jan. 1937, pp. 7–8. Review of conditions in cities of Ohio and upper Mississippi valleys; frost penetration and frozen services, Indianapolis, Ind.

COLD WEATHER OPERATION, WISCONSIN. 1935–36 Cold Weather Experiences in Wisconsin, W. A. Peirce. *Am. Water Works Assn.—J.*, vol. 29, no. 1, Jan. 1937, pp. 2–5, (discussion) p. 6. Review of measures taken to meet cold weather emergency; tabulated data on thawing service pipes; electrical thawing; troubles with mains.

DISTRIBUTION SYSTEMS. Proper Maintenance of Water Distribution System, J. S. Dunwoody. *Am. Water Works Assn.—J.*, vol. 29, no. 1, Jan. 1937, pp. 26–35. Review of practice of water department of Erie, Pa.; value of planning; record maps; Erie repair shop; motor repair room; stock room; value of shop and yard.

EMPLOYEES. Texas Seeks Security for Trained Men, C. Cohen. *Water Works Eng.*, vol. 90, no. 5, Mar. 3, 1937, pp. 273–275. Voluntary licensing system sponsored by State Board of Health and American Water Works Assn.; results of 3 years' operation.

METERS, MAINTENANCE AND REPAIR. Meter Maintenance and Repair, G. A. Roden. *Am Water Works Assn.—J.*, vol. 29, no. 4, Apr. 1937, pp. 529–531. Review of experience of meter division of water works of St. Paul, Minn., in maintenance and repair of meters; reasons for removing meters.

UNITED STATES. Water Works Systems for Federal Projects, E. W. Becker. *Am. Water Works Assn.—J.*, vol. 29, no. 2, Feb. 1937, pp 240–245. Construction of small water works systems for U. S. Federal Projects at Boulder City, Nev.; Greenbrook, N.J.; Greenbelt, near Washington, D.C.; Greenhills, Ohio; and Greendale, Wis.

WELLS. Construction of Gravel Wall Wells, R. R. Schweitzer. *Am. Water Works Assn.—J.*, vol. 29, no. 1, Jan. 1937, pp. 89–97. President of Layne–Atlantic Company, Norfolk, Va., discusses difficulties encountered in drilling water wells, cementing casings, and providing uniform holes through all formations; hydraulic mining system in under-reaming.

WELLS, GRAVEL WALLS. Gravel-Packed Wells, H. L. White. *Am. Water Works Assn.—J.*, vol. 29, no. 4, Apr. 1937, pp. 475–483, (discussion) 484–488. Review of recent progress in construction of gravel packed wells; proper size of gravel; casing materials; field drawdown; pump capacity; necessity of inspection.

WELLS, HAWAII. Wells for Water of Hawaii, N. D. Stearns. *Eng. News-Rec.*, vol. 118, no. 12, Mar. 25, 1937, pp. 450–452. Description of new type of water development in basaltic rock formation on volcanic island of Oahu permitting skimming of artesian basins at sea level, thus eliminating danger of salt water contamination; Maui type of well; artesian structure; flotation of fresh water; wells for Honolulu; conservation measures; distribution of groundwater areas on Oahu; sugar plantation supply; U. S. Army and Navy wells.

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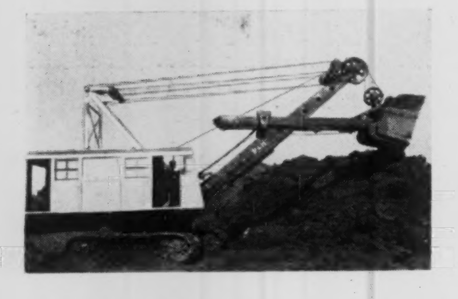

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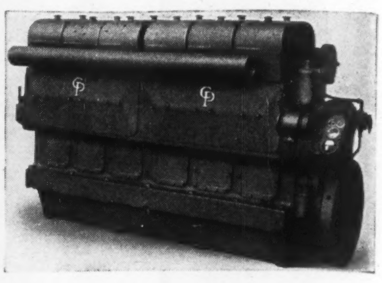
The adjustable power driven conveyor deposits the excavated material where desired, for loading into trucks or other carrying vehicles. Backed by 30 years' experience in building Ruth Dredgers, the excavator is sturdily built for hard working conditions, has a high efficiency in performance and low operating costs. Additional information can be secured from the Ruth Dredger Manufacturing Corporation, 5980 South Boyle Avenue, Los Angeles, California.

Device Locates Buried Pipes

A NEW instrument, which, it is said, quickly locates buried pipes, cables, and other objects made of metal, measures their depth, and permits the rapid and accurate mapping of underground metallic systems, with their branches and supplementary equipment, has been announced by the Fisher Research Laboratories Sales Company, Board of Trade Building, San Francisco, California and 45 Rockefeller Plaza, New York.

Diesel Engine for Heavy Duty



A MODERN DIESEL ENGINE incorporating the latest developments in construction, improved design and combustion control, is announced by the Chicago Pneumatic Tool Co., 6 East 44th Street, New York, N.Y. The engine is of the four-cycle, direct injection type, especially designed for medium speed and continuous duty. Known as the Type 8 CP Diesel engine, it is available in 3, 4, 6, and 8 cylinder sizes, with horsepower ratings of 90 to 300.

The various features of this new engine are described and illustrated in Bulletin No. 768.

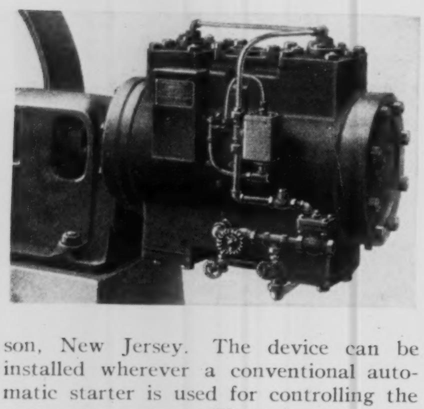
New Portable Pyrometer

A NEW millivoltmeter-type portable indicating pyrometer is being offered by The Bristol Company, Waterbury, Connecticut, for measuring temperatures up to 3000° F., using a thermocouple and extension leads. Use of a cobalt magnet allows increased sensitivity and a widened scale for more accurate readings. The high-resistance millivoltmeter movement is double-pivoted and completely shielded to prevent the effects of stray fields. The molded Bakelite case is of moisture- and dust-proof construction and modern design. The instrument is available in single and in double ranges.

Cab-Over-Engine Dump Truck Model

ANNOUNCEMENT is made of a short wheelbase truck with a new cab-over-engine conversion and special dump body mounted on a 1-½ ton Dodge truck chassis with a 108-in wheelbase. The dump body side is hinged horizontally for greater capacity and ease in loading ashes and other bulky materials. The slanting rear gate also gives slightly greater load space. It is equipped with a hydraulic hoist. This unit is for city work but is adaptable for other purposes. The short wheelbase provides small turning radius and greater facility for handling where little space is available.

Magnetic Unloader for Compressors



AUTOMATIC start-and-stop control, combined with automatic loading and unloading, can be obtained without additional equipment on motor-driven single-horizontal compressors by using the magnetic unloader introduced by Worthington Pump & Machinery Corporation, Harrison, New Jersey. The device can be installed wherever a conventional automatic starter is used for controlling the compressor motor. The only other provision necessary is a pressure switch to operate a pilot circuit. When connected to the magnetic unloader, the compressor runs continuously and loads and unloads depending upon the air demands.

New Universal Dual Plant

THE NEW Universal Dual Gravel Crushing, Screening, and Loading Plant is a modern development of the Universal Crusher Company of Cedar Rapids, Iowa.

The manufacturer claims high efficiency and low cost operation for this compact plant which employs the following Standard Universal equipments: a No. 936 jaw crusher, a 30 by 16 in. roll crusher, a 4 by 8 ft double deck gyrating screen, and a sand rejector. The entire assembly is mounted on a heavy duty goose-neck type six-wheeled truck with twelve pneumatic tires. A 52 ft by 24 in. feeder belt conveyor; a 52 ft by 18 in. delivery belt conveyor, and a 21 yd steel jackleg bin complete the assembly. Universal portable plants of this type are made for handling 100 to 200 tons per hour and over.

Portable Conveyor

A LIGHT, sturdy, easily portable, and moderately priced conveyor is announced by the Atlas Conveyor Co. of Clintonville, Wis.

The new Atlas high speed portage conveyor is built in one standard size: length 24 ft; belt width 16 in.; capacity 25 to 90 tons per hr, depending upon material handled. It is powered by a 3 hp electric motor or a 3 to 5 hp gasoline engine with chain and sprocket drive. The discharging height has a maximum reach of 11 ft; with a charging height of 13 in. An 18-in. belt width is also furnished but special lengths are built to order. The unit is mounted on 30 by 5 in. road wheels equipped with high pressure pneumatic tires.

Folders Announced

AERATION—The third revision of Engineering Bulletin No. 1, entitled "Aeration of Sewage and Water with Porous Air Diffusers" is a 32 page booklet covering many details of this subject. Carborundum Co., Niagara Falls, N.Y.

AUTO PATROLS—"Caterpillar" Auto Patrols, the work they will do and their mechanical features, illustrated with action pictures, model views and photographic details, is the subject matter of a 40-page booklet (Form 4052) just issued by the Caterpillar Tractor Co., Peoria, Ill.

DIESEL ENGINES IN PUMPING—The Caterpillar Tractor Company points out in a series of excellent photographs and explanatory captions, the outstanding performance both in the United States and abroad of Diesel engines in pumping for irrigation, running sand pumps, working on dredges, pumping for mines and pumping crude oil and gasoline, in its new 12-page booklet, Form 4148, "Solving Pumping Problems with 'Caterpillar' Diesel Engines." Caterpillar Tractor Co., Peoria, Ill.

FLOW METERS—Details regarding the new Electric Flow Meter and its operation, using Bristol's Metameter principle of telemetering, and information on Mechanical Flow Meters, for recording, integrating, controlling and indicating the flow of steam, gases or liquids, are contained in a new 40-page catalog available for distribution by The Bristol Co., Waterbury, Conn.

GAUGES RECORDING—Several new bulletins on recording and controlling gauges, bulletins No. 483, No. 484, and No. 486, have just been published by The Bristol Co., Waterbury, Conn.

MONEL WIRE SCREEN AND FILTER CLOTH—The non-corrosive properties, the strength and adaptability of this type of wire screen and filter cloth, and its use in making separations by screening or filtration are described in an illustrated, 18 page, $8^1/_2$ by 11 in booklet. The International Nickel Co., Inc., 67 Wall Street, New York, N.Y.

PNEUMATIC TIRES—An 8-page booklet covers data on pneumatic tires for earth moving equipment. Operators of earth moving equipment will be interested in the complete tables showing the sizes, number of plies, rims, loads per tire, and recommended inflation pressure of each tire made for this type of equipment. B. F. Goodrich Co., Akron, Ohio.

PUMP PARTS—The long life of Monel piston rods, shafts, lines, sleeves, valves and impellers installed in many types of pumps is described and illustrated in a 6-page folder. The International Nickel Co., Inc., 67 Wall Street, New York, N.Y.

PUMPS—Ball bearing centrifugal pumps, built to operate at high speeds against heads up to 245 ft with capacities from 90 to 225 gal per min are described in a 4-page bulletin, No. 5870. Another F-M bulletin, No. 6150, covers in 6 pages Simplex self-oiling power pumps suitable for pumping at pressures up to 300 lb per sq in. and in quantities up to 29 gal per min. Fairbanks, Morse & Co., Chicago, Ill.

ROOFING AND SIDING—Cutting maintenance costs on industrial work is discussed in "J-M Corrugated Transite" published by Johns-Manville. How Corrugated Transite can be applied by any average workman is explained, with drawings showing construction details. Also illustrated are patented accessories for sealing joints and ridges, and typical installations. Johns-Manville, 22 East 40th Street, New York, N.Y.

SEGMENT BLOCK—The advantages of Robinson Single-Ring Segment Block for sewer construction are summarized in a new 4-page folder which includes installation photographs and a table showing savings in excavation. Robinson Clay Product Company, Akron, Ohio.

SHEET METAL—"A Guide for Sheet Metal Workers" has just been published by the United States Steel Corporation Subsidiaries. This booklet presents sales material and tables, as well as fabricating hints on USS Sheet Products. It includes photographs taken in typical fabricating plants and sheet metal shops, and lists of products which may appeal to the independent sheet metal worker who does a wide variety of jobs to order. Copies may be obtained from district sales offices of the United States Steel Corporation Subsidiaries.

SHOVEL—The three-quarter swing Badger Shovel, designed with the single object of speeding up output, and said to be constructed with the lightest possible swinging weight, greatest stability, complete visibility and elimination of tail swing, is described as to equipment and performance in Bulletin No. 1683 of The Austin Western Road Machinery Co., Aurora, Ill.

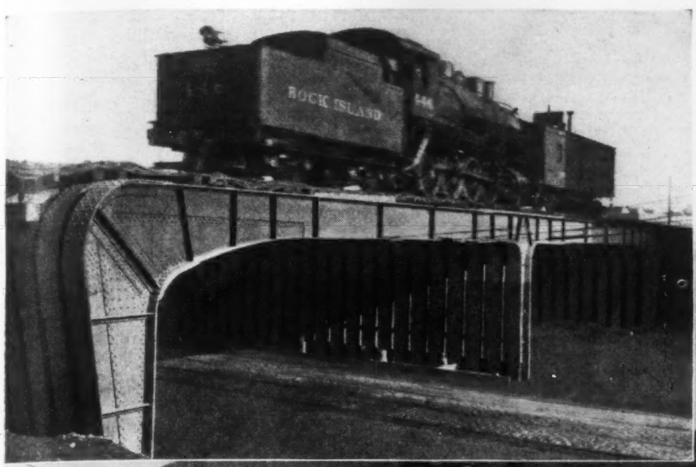
TRACTORS—An illustrated booklet, Form 4189, entitled "'Caterpillar' Tractors in All Lands" deals with this type of Diesel tractor at work with trailbuilders, bulldozers, brush cutters, winches, scrapers, tamping welders and rippers. Caterpillar Tractor Co., Peoria, Ill.

VACUUM HEATING PUMPS—The power saving factors of the Jennings Return Line Vacuum Heating Pump are described and illustrated in a booklet which also contains tables of rating, capacity and power requirements, approximate dimensions and pipe sizes. Bulletin No. 267 Nash Engineering Co., South Norwalk, Conn.

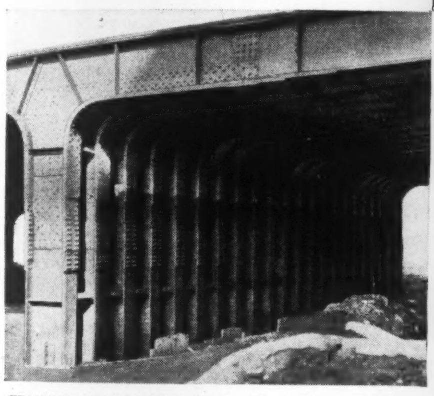
VALVES TRIMMED WITH MONEL—A 4-page folder, well illustrated, and concisely written, gives interesting service records of valves trimmed with Monel Metal. The International Nickel Co., Inc., 67 Wall Street, New York, N.Y.

WELDING—"The Welding of Enduro Stainless Steel" is a new 20-page booklet (Form 180) obtainable from Republic Steel Corp., Cleveland, Ohio. It illustrates and described the proper methods for welding stainless steel by electric arc, gas, seam, spot, projection and atomic hydrogen methods, includes information on brazing and silver soldering, and a table showing in condensed form the physical, electrical and mechanical properties of thirteen types of Enduro Stainless Steel contrasted with similar properties of a carbon steel, S.A.E. 1020.

BEAM ARCH CONSTRUCTION gives Clear Deck



THE CERMAK ROAD BRIDGE *is a two-span rigid frame structure of the Beam Arch type. The four-track deck is 56 feet, 6 inches wide and each span measures 63 feet, 2 inches between centers of bearing. Vertical loads only are taken by the piers, the arch thrust being carried by eye-bars encased in concrete.*



CENTER SUPPORTS *of the 23 double-arch ribs which are spaced 2 feet 6¾ inches on centers.*

Cermak Road Bridge was constructed for the State of Illinois, Dept. of Public Works and Buildings, Division of Highways; Ernest Lieberman, Chief Engineer. All steelwork was fabricated by American Bridge Company.

THE four-track right-of-way of the New York Central and the Chicago, Rock Island and Pacific Railroads, crosses Cermak Road in Chicago on 23 Beam Arch Ribs. This construction provides a clear-deck roadbed, readily maintained, which permits cross-overs at any point because unobstructed by top flanges of through girders. The shallow floor reduces the amount of excavation or embankment fill needed to maintain underneath clearances.

Beam Arch Construction, developed by American Bridge Company, is fabricated from Carnegie-Illinois rolled CB Beams and shipped in large sections for speedy erection and minimum traffic interruption. Beam Arch bridges are pleasing in their treatment of the vaulted profile. They embody all the sturdiness and rigidity inherent in the continuous rigid frame. They are economical to construct, easily inspected and painted after completion.

Other applications where Beam Arch Construction is particularly valuable, are in auditoriums, gymnasiums and assembly halls where large unobstructed space is required. Call upon us to meet your special requirements.

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General Offices: Frick Building, Pittsburgh, Pa.

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performance and . . .
0 times more Diesel Service Hours!

Are you getting the full output that your "Caterpillar" Diesel Engine or Tractor will give?

You'll get highest performance and also cut operating costs by using Ten-ol, the new, fused lubricant developed by Sinclair for "Caterpillar" Diesels.

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nclair TENOL is recommended as a "new outstanding Diesel engine lubricant" by Caterpillar Tractor Co.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1937. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

Air Conditioning in the Home. By E. Torok. New York, Industrial Press, 1937. 296 pp., diagrs., charts, tables, 9 × 6 in., leather, $3.

This book explains the important advantages of air conditioning, the fundamental principles, equipment, and systems in use, and gives definite data for everyone interested either in partial or complete air conditioning. Covers the use of psychrometric tables, heating calculations, and the 1937 Standard Code for Heating Systems.

Eidgenössische Materialprüfungsanstalt an der E.T.H. in Zürich, Laboratoire Fédéral d'Essai des Matériaux, Annexé à l'École Polytechnique Fédérale a Zürich, Switzerland. Der Bau von Brücken, Gerüsten und Hochbauten aus Holz in der Schweiz. Beilage zum Diskussionsbericht Nr. 5 der E.M.P.A., Erste Ergänzung. Zürich, October 1936. illus., diagrs., 13 × 10 in., paper, apply.

This report issued as a supplement to Discussion Report No. 5 (1925) of the Federal Testing Laboratory, Zurich, contains some eighty photographs of old Swiss wooden bridges, together with photographs of noteworthy wooden bridges, scaffoldings, and large buildings erected during the last decade. Brief information as to designers and builders is given. The collection is an interesting exposition of the uses of wood in construction.

Great Britain. Ministry of Transport, Roads Department. Experimental Work on Roads. Reports for the Years 1933, 1934, and 1935–1936 of the Experimental Work on Highways (Technical Committee.) London, His Majesty's Stationery Office, 1934–1936. Diagrs., charts, tables, 10 × 6 in., paper, 1933, 107 pp., 50 cents; 1934, 139 pp., 50 cents; 1935–1936, 106 pp., 35 cents. (Obtainable from British Library of Information, 270 Madison Ave., New York.)

These reports cover the first three years of work by this committee, which is engaged in full-scale tests upon roads under normal traffic conditions. The reports present the results of studies of the behavior of cement and cement-bound macadam roads, tar and bituminous surfacings, and various surface dressings under varied traffic conditions.

Great Britain. Dept. of Scientific and Industrial Research and Ministry of Transport. Road Research. Technical Paper No. 4. The Control of the Moisture Content of Aggregates for Concrete, Introducing a New Vibration Method, by F. N. Sparkes. London, His Majesty's Stationary Office, 1936. 26 pp., illus., diagrs., charts, tables, 10 × 6 in., paper. (Obtainable from British Library of Information. 270 Madison Ave., New York, 30 cents.)

Describes a new way of dealing with the problem of the control of the water-cement ratio in concrete, tending to a greater uniformity in the strength and other properties.

Handbuch des Maschinenwesens beim Baubetrieb. Vol. 3, Parts 1 and 2. By G. Garbotz. Part 1 published by Julius Springer, Berlin, 1937. 652 pp., 96 rm.; Part 2 published by VDI-Verlag, Berlin, 1937, 322 pp., about 45 rm. Illus., diagrs., charts, tables, 10 × 7 in., leather.

This third volume, in two parts, of a handbook on construction machinery, covers the moving of earth and rock. Part 1 treats of excavating, scraping, and dumping machinery, with examples of large earth-moving projects. A pocket contains many tables of actual dimensions and costs of various machines. Part 2 covers conveying equipment, track construction, and rail-shifting machinery. A comprehensive review of practice, with numerous bibliographies, is provided.

Highway Research Board. Proceedings of the Sixteenth Annual Meeting held at Washington, D. C., November 18–20, 1936. Edited by R. W. Crum. National Research Council, Division of Engineering and Industrial Research, Washington, D.C., 1937. 390 pp., illus., diagrs., charts, tables, 10 × 7 in., cloth, $1.75.

Contains general information about the Highway Research Board, and copies of the papers and reports presented at the 1936 annual meeting, classified under the various departments.

Law for Engineers and Architects. By. L. P. Simpson and E. R. Dillavou. 2 ed. St. Paul, Minn., West Publishing Co., 1937. 692 pp., 9 × 6 in., cloth, $4.50.

Text and case materials stating and illustrating the fundamental principles of law in those branches that bear most directly upon the engineering profession. In particular, the law of contracts has been treated at great length. Standard contract forms are illustrated in an appendix.

Man in a Chemical World, the Service of Chemical Industry. By A. C. Morrison. New York and London, Charles Scribner's Sons, 1937. 292 pp., illus., diagrs., charts, tables, 9 × 7 in., cloth, $3.

An account of the activities of chemical industry in converting the discoveries of science into day-by-day necessities. Various fields of activity are considered, and the part played by chemistry in their development is demonstrated. Betterment of existing materials, the creation of new ones, and the replacement of scarce or waning natural resources with synthetic substitutes are examples.

Manning Formula Table for the Solution of Pipe Problems. By H. W. King. New York and London, McGraw-Hill Book Co., 1937. 351 pp., tables, 9 × 6 in., leather, $5.

The table here presented gives a solution of the Manning formula throughout the range of conditions ordinarily encountered in solving pipe problems. The tabulated values are in inches corresponding to different rates of loss of head and different degrees of roughness, and results can usually be taken from the table directly or by mental interpolation. The table is applicable to all circular conduits flowing full, including sewers and drain tile as well as pressure pipes.

Marconi, the Man and His Wireless. By O. E. Dunlap, Jr. New York, Macmillan Co., 1937. 360 pp., illus., 9 × 6 in., cloth, $3.50.

In this biography, as in that of so many important men, the man's work is an integral part of his life, and the biography becomes a historical sketch of the field in which he worked. So here we find a "biography" of wireless telegraphy, from infancy to maturity, combined with personal information concerning Marconi.

Mitteilungen aus dem Institut für Baustatik. Mitteilung Nr. 8. Das Talsperrengewölbe, by K. Hofacker. Zürich and Leipzig, A.G. Gebrüder Leeman & Co., 1936. 125 pp., illus., diagrs., charts, tables, 9 × 6 in., paper, 4.50 rm, 7.50 Swiss frs.

A general investigation of circular fixed arches according to the mathematical theory of elasticity. Tests on models are described, giving the results. The last chapter contains a comparison of the rigorous solution of arch-dam problems with the customary approximate solutions.

Physical Testing of Metals and Interpretation of Test Results. By H. D. Churchill. Cleveland, American Society for Metals, 1936. 109 pp., illus., diagrs., charts, tables, 9 × 6 in., leather, $2.

This book contains five lectures upon the tests for tension, compression, shear, bending, hardness, impact and fatigue, and some special tests in common use. The purpose of each test, the information to be expected from it, the method of applying it, and the analysis of the results are discussed, with the object of clarifying their use and securing greater uniformity. The lectures were delivered before the American Society of Metals.

Public Works Engineers' Yearbook 1937. Proceedings of American Society of Municipal Engineers International Association of Public Works Officials. Chicago, American Public Works Association (850 East Fifty-Eighth Street), 1937. 308 pp., illus., tables, 9 × 5½ in., cloth, $3.

This report of the Public Works Congress, held at Toronto, Canada, September 28–October 1, 1936, includes papers on such subjects as sewerage, water supply, traffic safety, and other current municipal problems. Business meetings are concisely reported, making the volume the annual proceeding as well as a comprehensive survey of public works developments in the past year.

Refrigeration Engineering. By H. J. Macintire. New York, John Wiley & Sons, 1937. 415 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $4.50.

The expanded field of refrigeration engineering has been treated here from the fundamentals to the numerous special adaptations. Assuming a knowledge of thermodynamics, the early chapters cover refrigerants and refrigerating cycles, heat transfer, and fluid flow. After consideration of general systems and mechanical parts the refrigerating machines are discussed, including operation and testing. There are also chapters on air conditioning, cold storage, ice manufacture, and other applications.

Sentinal of the Coasts, the Log of a Lighthouse Engineer. By G. R. Putnam. New York, W. W. Norton & Co., 1937. 368 pp., illus., maps, 9 × 6 in., cloth, $3.50.

An autobiographical account of the experiences of an engineer who has been engaged in lighthouse work for most of his life. It describes lighthouses, lightships, beacons and buoys, and their use and maintenance on inland and ocean waters throughout the range of territory covered by the United States. For many years U. S. Commissioner of Lighthouses, Mr. Putnam describes the governmental activities in this picturesque field.

Strength of Materials. By A. P. Poorman. 3 ed. New York and London, McGraw-Hill Book Co., 1937. 314 pp., diagrs., charts, tables, 9 × 6 in., cloth, $3.

This standard textbook covers the field of elementary strength of materials. It includes stresses and strains in general, riveted and welded joints, torsion of shafts, stresses and deflections of beams of various types, column formulas, and resilience. Illustrative problems and useful tables are given in order to show practical applications of the theories developed.

Structural Engineering Problems. By D. A. Molitor. Washington, D.C., D. A. Molitor, 1445 Spring Road, N.W., 1937. 155 pp., diagrs., charts, tables, 9 × 6 in., paper, $2.75

Dr. Molitor's treatise is devoted to statically indeterminate structures, particularly to some problems that have not received adequate consideration in the literature. The opening chapters lay the foundation for a comprehensive understanding of structural problems by developing methods of diagnosis, discussing the principal systems of structures and their governing laws, and presenting a method of stress analysis by Mohr's work equation which is practically universal in its application. An extensive series of practical problems solved by this method is followed by chapters on wind stresses, continuous concrete beams, earth pressure and retaining walls, sheet piling and revetments, wave pressure and sea walls, cylindrical steel tanks, and arch roof trusses.

Valuation of Property. 2 Vols. By J. C. Bonbright. New York and London, McGraw-Hill Book Co., 1937. 1271 pp., 9 × 6 in., cloth, $12.

A presentation of the results of a research in legal and economic theories of property valuation. Vol. I covers concepts of value, methods of valuation, and valuation for specific legal purposes. Vol. II covers various specific cases of valuation under certain rules, tax restrictions, and other legal considerations. It also includes both a case index and a subject index.

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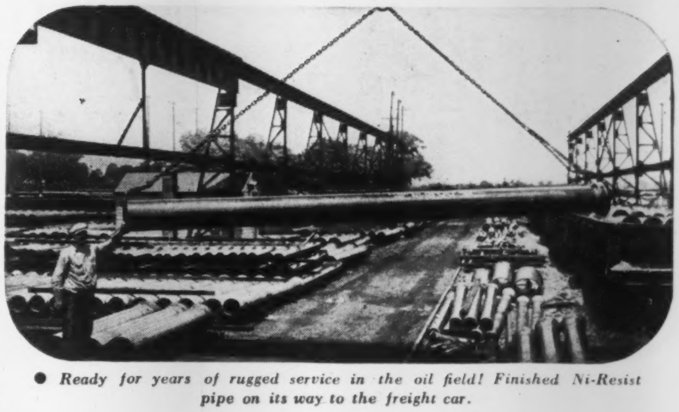
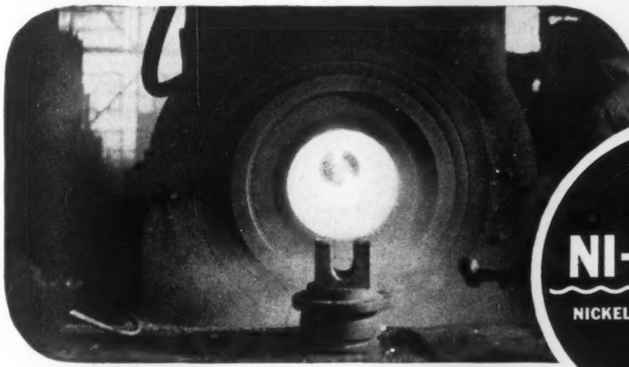


● *Ready for years of rugged service in the oil field! Finished Ni-Resist pipe on its way to the freight car.*



• *Here's where the Ni-Resist pipe gains the toughness and density of structure that makes it invaluable to you in the field. Casting by the Super-de-Lavaud process.*

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Ni-Resist contains usually 14% nickel, 6% copper and 2% chromium. It has a high degree of toughness, machines readily and is non-magnetic. All in all it gives you a pipe which is superior to unalloyed cast iron especially in service involving corrosives.

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CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

Lift, Chicago. Erecting 56-Ton Sheaves for Calumet River Bridge. *Eng. News-Rec.*, vol. 118, no. 21, May 27, 1937, pp. 774–775. Description of special equipment set-up required to raise 56-ton operating sheaves for a vertical distance of 210 ft to tops of towers of Torrence Avenue lift bridge in Chicago.

Masonry Arch, Wrecking. Demolition of Waterloo Bridge, E. J. Buckton and H. J. Fereday. *Instn. Civ. Engrs.—J.*, no. 8, Oct. 1936, pp. 472–498, (discussion) 499–522, 3 supp. sheets. Detailed procedure of demolition of old bridge in London, England, consisting of nine masonry arches of 120-ft clear span each.

Railroad, Mexico. Los Puentes en el Ferrocarril del Sureste, P. A. Gonzalez. *Revista Mexicana de Ingenieria y Arquitectura*, vol. 15, no. 3, Mar. 1937, pp. 137–174, and maps. Bridges on Southeast Railroad; general conditions on railroad under construction, to unite Isthmus of Tehuantepec with Peninsula of Yucatan, across states of Veracruz, Tabasco, Chiapas, and Campeche, and to link up with main lines; location of river crossings; 16 bridges required, with total length 1,686 m; also 11 short spans with total of 240 m; study of bridge types; résumé of selected types.

Steel Arch, Reconstruction. Reconstruction and Widening of Margaret Bridge Over Danube at Budapest, C. Szechy. *Structural Engr.*, vol. 15, (new series), no. 3, Mar. 1937, pp. 110–127. Reconstruction of steel arch bridge completed in 1876, consisting of six hingeless wrought-iron arch girders, 255 ft to 336 ft long, including widening of its roadway from 36 ft 10 in. to 55 ft; construction of four pedestrian tunnels crossing roadway.

Steel, Welding. Welded Road Bridge Girders Built on 70-Ft Span, O. M. Bloch. *Eng. News-Rec.*, vol. 118, no. 20, May 20, 1937, p. 741. Design and construction of welded plate-girder spans for highway bridge at Livingston Manor, N.Y.

Suspension, Great Britain. Inverness Bridge, H. F. Wilmot. *Civ. Eng.* (*London*), vol. 31, no. 366, Dec. 1936, pp. 411–413, 1 supp. sheet. Reconstruction of suspension bridge span, 225 ft long, over Ness River, Scotland, consisting of two suspension chains of wrought iron, formed of links approximately 15 to 23 ft long; span is supported on two masonry towers of unequal height, 45 ft and 14 ft, respectively.

Suspension, New York City. Bronx-Whitestone Bridge. *Gen. Contractors Assn.—Bul.*, vol. 28, no. 4, Apr. 1937, pp. 69–70. Main features of proposed suspension bridge of 2,300-ft center span and 735-ft side spans, which will provide minimum clear height of 135 ft above mean high water above channel; estimated cost $18,000,000.

Suspension, Quebec. Superstructure of Island of Orleans Suspension Bridge, Quebec, Canada, S. R. Banks. *Instn. Civ. Engrs.—J.*, no. 8, Oct. 1936, pp. 357–421, (discussion) 422–470, 4 supp. sheets. Design, fabrication, and erection of new suspension bridge over North Channel of St. Lawrence River near Quebec, having main span of 1,059 ft and total length between anchorages of 2,370 ft; details of steel frame tower 216 ft high.

Viaducts, Steel. Continuous Girders Top Rigid Frame Viaduct Bents. *Eng. News-Rec.*, vol. 118, no. 18, May 6, 1937, pp. 671–673. Design and construction of rigid-frame, 2-story column bents, 140 ft wide, of silicon steel, ranging in height from 45 to 65 ft, for Chicago Outer Drive viaduct; details of girder column connections, abutment retaining wall, expansion joints involving bronze rocker plate, and chrome steel bearing plate, etc.

BUILDINGS

Construction. Unique Methods for Winter Construction of Large Factory near Toronto. *Eng. & Contract Rec.*, vol. 50, no. 51, Dec. 16, 1936, pp. 1103–1107. Winter construction of reinforced concrete building of Continental Can Company of Canada, at New Toronto, Ontario; use of complete enclosure featuring movable roof jacked up as work proceeded; extensive use made of plywood for forms.

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CITY AND REGIONAL PLANNING

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Great Britain. Town Planning and Interim Development Administration in Southport, F. C. Loades. *Instn. Mun. & County Engrs.—J.*, vol. 63, no. 9, Oct. 27, 1936, pp. 651–659, (discussion) 660–662. Methods adopted in dealing with town planning schemes in Southport; building lines; tree planting in streets; zoning; industrial development; shopping areas; road widenings and new roads; corporation estate development; planning of agricultural belt.

Housing, Capetown, South Africa. Some Problems of Town Planning, Slum Clearance, and Housing in Capetown, J. C. Collings. *Instn. Mun. & County Engrs.—J.*, vol. 63, no. 6, Sept. 15, 1936, pp. 405–423 (discussion), 423–428. Town planning legislation; slum clearance and housing; replanning slum-clearance areas; survey and preliminary practice; building regulations; interim development; building lines; flats, terraces, and semi-detached cottages; industrial expansion; harbor and foreshore development.

Mexico City. Plan Development of Mexico City, C. Contreras. *Arch Rec.*, vol. 81, no. 4, Apr. 1937, pp. 4–7. History of development of city of Mexico and review of recommended plans for its expansion and modernization.

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Disintegration. Sur la corrosion du béton, B. Isačenko. *Académie des Sciences de l'URSS—C. R.*, vol. 2, no. 7, 1936, pp. 287–289. Report from Hydrological Institute of Leningrad, U.S.S.R., on original observations of disintegration of concrete caused by bacteria; effect of hydrogen-ion concentration. Bibliography. (In French.)

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DAMS

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Earth, National Forests. Earth Dams and Roads in National Forests, T. W. Norcross. *Highway Research—Proc.*, vol. 16, mtg. Nov. 18–20, 1936, pp. 277–281, (discussion) 281. Control exercised over selection of embankment material and measures followed during construction operations; need of improved technique, particularly in localities where natural materials are not well suited to present methods; two experimental road stabilization projects described.

Hydraulic Fill, Drainage. Fort Peck Dam Closure Slopes Drained by Perforated Metal Pipes. *Eng. News-Rec.*, vol. 118, no. 21, May 27, 1937, p. 773. Description of 8-in. perforated corrugated iron pipes for draining slopes of hydraulic-fill dam; effect of drainage system on seepage through fill slope.

How many have original Cast Iron Mains in Service?

Look at this list of 212 cities. There are 204 with solid black symbols indicating original cast iron water mains in service.* Note the 10 stars signifying cast iron pipe in service for a century or more. Only a material with great *bursting* strength, *beam* strength, *crushing* strength, *impact* strength, and effective resistance to corrosion—indispensable requirements of an underground main—can render such enduring and economical service.

THE ANSWER IS

96%

SYMBOLS: ✪ *In service 100 years or more* □ *50 to 99 years* ○ *under 50 years*

SOLID SYMBOLS INDICATE ORIGINAL PIPE IN SERVICE

ALABAMA
- □ Birmingham
- ■ Mobile
- ■ Tuscaloosa

ARKANSAS
- ■ Fort Smith
- ■ Little Rock

CALIFORNIA
- ● Alhambra
- ● Fresno
- ● Long Beach
- ■ Oakland
- ■ Pasadena
- ■ San Diego
- ■ Los Angeles
- ■ Sacramento
- ■ San Francisco
- ■ Stockton

COLORADO
- ■ Denver
- ● Fort Collins
- ■ Pueblo

CONNECTICUT
- ■ Hartford
- ■ New London
- ■ Stamford

DELAWARE
- □ Wilmington

DISTRICT OF COLUMBIA
- ■ Washington

FLORIDA
- ■ Jacksonville
- ■ Orlando
- ● St. Augustine
- ● West Palm Beach

GEORGIA
- ■ Atlanta
- ■ Augusta
- ● Decatur
- ■ Macon

IDAHO
- ● Boise
- ● Pocatello

ILLINOIS
- ● Berwyn
- ■ Bloomington
- ■ Chicago
- ■ Elgin
- ■ Evanston
- ■ Galesburg
- ■ Moline
- ■ Oak Park
- ■ Peoria
- ■ Quincy
- ■ Rockford

INDIANA
- ■ Elkhart
- ■ Evansville
- ■ Fort Wayne
- ● Gary
- ■ Indianapolis
- ■ La Fayette
- ■ Michigan City
- ■ Richmond
- ■ Terre Haute

IOWA
- ■ Burlington
- ■ Davenport
- ■ Des Moines
- ■ Dubuque
- ■ Ottumwa

KANSAS
- ■ Hutchinson
- ■ Topeka

KENTUCKY
- ■ Covington
- ■ Louisville
- ■ Paducah

LOUISIANNA
- ● New Orleans
- ■ Shreveport

MAINE
- ■ Bangor
- ■ Portland

MARYLAND
- ★ Baltimore
- ■ Hagerstown

MASSACHUSETTS
- ■ Boston
- □ Brockton
- ■ Cambridge
- ■ Chelsea
- □ Fall River
- ■ Fitchburg
- ■ Holyoke
- ■ Lowell
- ● Malden
- ■ New Bedford
- ■ Newton
- ● Revere
- □ Somerville
- ■ Springfield
- ■ Taunton
- ■ Waltham
- ■ Worcester

MICHIGAN
- ■ Ann Harbor
- ■ Battle Creek
- ■ Bay City
- ● Dearborn
- ■ Detroit
- ■ Flint
- ■ Grand Rapids
- ● Hamtramck
- ● Highland Park
- □ Kalamazoo
- ■ Muskegon
- ■ Port Huron

MINNESOTA
- ■ Duluth
- ■ Minneapolis
- ■ St. Paul

MISSISSIPPI
- ● Jackson
- ■ Vicksburg

MISSOURI
- ★ St. Louis
- ■ Kansas City
- ■ Springfield

MONTANA
- ● Billings
- ● Great Falls
- ● Missoula

NEBRASKA
- ■ Lincoln
- ■ Omaha

NEW HAMPSHIRE
- ● Berlin
- ■ Concord
- ■ Manchester
- ■ Nashua

NEW JERSEY
- ■ Atlantic City
- ● Elizabeth
- ■ Hoboken (Hackensack Water Co.)
- ■ Jersey City
- ■ Newark
- ■ New Brunswick
- ■ Paterson
- ● Plainfield

NEW YORK
- ■ Amsterdam
- ■ Binghamton
- ■ Elmira
- ■ Jamestown
- ■ Kingston
- ■ Mt. Vernon
- ■ New Rochelle
- ✪ New York City
- ● Niagara Falls
- ■ Rochester
- ■ Syracuse
- ■ Utica
- ■ Yonkers

NEW MEXICO
- ● Roswell

NORTH CAROLINA
- ■ Asheville
- ■ Charlotte
- ■ Durham
- ● Greensboro
- ● High Point
- ● Raleigh
- ■ Wilmington

NORTH DAKOTA
- ■ Bismark
- ■ Fargo
- ■ Grand Falls

OHIO
- ■ Akron
- ■ Cincinnati
- ■ Cleveland
- ● Cleveland Hts.
- ■ Columbus
- ● East Cleveland
- ■ Hamilton
- ■ Lima
- ● Marian
- ■ Newark
- ■ Toledo
- ■ Warren
- ■ Youngstown

OKLAHOMA
- ● Ada
- ● Enid
- ● Oklahoma City

OREGON
- ● Eugene
- ■ Portland

PENNSYLVANIA
- ■ Erie
- ■ Jamestown
- ★ Lancaster
- ■ New Castle
- ★ Philadelphia
- □ Pittsburgh
- ★ Reading
- ● Wilkensburg
- ■ York

RHODE ISLAND
- ■ Cranston
- ■ Pawtucket
- ■ Providence
- ■ Woonsocket

SOUTH CAROLINA
- ■ Charleston
- ● Greenville
- ■ Spartanburg

TENNESSEE
- ■ Chattanooga
- ■ Knoxville
- ★ Nashville

TEXAS
- ■ Dallas
- ■ Fort Worth
- ● San Angelo
- ■ Texarkana

UTAH
- ■ Provo
- ■ Salt Lake City

VIRGINIA
- ★ Lynchburg
- ● Newport News
- ■ Norfolk
- ■ Petersburg
- ● Portsmouth
- ★ Richmond

WASHINGTON
- ● Bellingham
- ■ Seattle
- ■ Tacoma

WEST VIRGINIA
- ● Clarksburg
- ★ Wheeling

WISCONSIN
- ■ Eau Claire
- ■ Fond DuLac
- ■ Green Bay
- ● Kenosha
- ■ Madison
- ■ Milwaukee
- ■ Oshkosh
- ■ Racine
- ● Sheboygan
- ● Superior
- ● West Allis

*In a few instances gas mains are referred to where they are older than water mains.

THE CAST IRON PIPE RESEARCH ASSOCIATION
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Hydraulic Gates. New Crest for Dams, W. Bauknight. *Eng. News-Rec.*, vol. 118, no. 18, May 6, 1937, pp. 665–667. Features of so-called Sidney crest gate for new Emsworth Dam on Ohio River, combining certain features of Tainter and vertical-lift types in that it revolves part way and then lifts vertically to height required to clear opening; comparison of cost, weights, and advantages of roller, vertical lift, and Sidney gates.

Hydraulic Gates, Classification. Considerations on Design and Choice of Gates for Large Hydraulic Conduits, B. A. Halliday. *Reclamation Era*, vol. 26, no. 10, Oct. 1936, pp. 241–243. Classification of hydraulic gates as to types of moving surfaces; hydraulic characteristics; gate seals; hoisting equipment.

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Weirs. Practical Hydraulics. IV—Float Gages, P. S. Wilson. *Water Works & Sewerage*, vol. 84, no. 4, Apr. 1937, pp. 119–120. Review of practice as to float and float pipe; rigid stem and flexible wire gages; gage with tape; indicators and recorders.

Weirs, Discharge. Flow of Water over Masonry Weirs and Notches, M. L. Garga. *Engineer*, vol. 163, no. 4231, Feb. 12, 1937, p. 186. Notes on calibration of certain falls and discharge (flow) measurement sites to be used as control points in regulation of Sarda canal system, Oudh. Abstract of paper before Instn. of Engrs. (India).

FLOOD CONTROL

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Ohio River. Ohio River Flood Control Plan, H. H. Pohl. *Am. Water Works Assn.—J.*, vol. 29, no. 5, May 1937, pp. 589–596. Early floods; methods of flood control; reservoirs for flood control; Army Engineers' plan; reservoirs not complete protection; local cooperation necessary.

Reservoirs. Partial Flood-Control Storage Valuable in Extreme High Water, C. I. Grimm. *Eng. News-Rec.*, vol. 118, no. 21, May 27, 1937, p. 779. General discussion of value of reservoirs for flood control; comparison of regulated and unregulated Willamette River flood stages and effects, showing that partial control by four reservoirs would reduce flood damage to 2 per cent of unregulated damage.

FOUNDATIONS

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Cofferdams, Construction. Cofferdamming Difficulties in Narrow Tideway, E. R. Albertson. *Eng. News-Rec.*, vol. 118, no. 20, May 20, 1937, pp. 729–732. Tidal currents, ground swell, old foundation obstructions, and other difficulties encountered in construction of cofferdam for bridge at mouth of Shark River between Avon and Belmar, N.J.; driving new piles; concrete seal and pier.

Foundations, Subsoils. Soil and Foundation Conditions in Mexico City, J. A. Cuevas. *Arch. Rec.*, vol. 181, no. 4, Apr. 1937, pp. 8–9. Review of foundation conditions as affected by presence of large underground lake; simple methods of testing conditions.

Piles, Steel. Structural Steel Bearing Piles—Their Use and Capacity, E. L. Durkee and R. L. McIntosh. *Boston Soc. Civ. Engrs.—J.*, vol. 24, no. 2, Apr. 1937, pp. 78–104. Development and use of metallic piles, particularly H-pile; results of tests of bearing capacity of piles compared with values given by several accepted formulas.

Piles, Steel, Testing. Lateral Loading Tests Made on Steel Bearing Piles, H. A. Vierheller. *Eng. News-Rec.*, vol. 118, no. 18, May 6, 1937, pp. 667–669. Tests of two monoliths, each 10 by 10 by 4 ft, 18 in. apart, each supported by four 10 by 10-in. 42-lb H-section steel piles (Carnegie-Illinois CBP 103), 30 ft long, driven in sand and gravel to rock under Emsworth Dam on Ohio River, to determine what lateral loads could be assumed in design of structure.

Retaining Walls, Demolition. Concrete Wall Broken Up by Many Small Powder Charges. *Eng. News-Rec.*, vol. 118, no. 21, May 27, 1937, p. 769. Method of demolishing concrete retaining wall, 200 ft long, 18 ft maximum height, 7.2 ft maximum thickness, in connection with widening of Pacific highway near Oregon City, Ore.; powder charges were placed in holes drilled downward in concrete from top of wall and also in holes drilled into exposed face of concrete.

Retaining Walls, Design. Correlation of Soil Mechanics Studies with Design and Construction of Retaining Walls, R. F. Legget. *Eng. & Contract Rec.*, vol. 50, no. 45, Nov. 4, 1936, pp. 1000–1004. Test boring and sampling; soil testing and construction problems; tests on completed structures. Before First Int. Conference on Soil Mechanics and Foundation Eng.

HYDRAULIC ENGINEERING

Flow of Water, Measurement. Ueber den Einfluss der Bohrungen auf die Druckanzeige, A. Miyadzu. *Tôhoku Imperial Univ.—Technology Reports*, vol. 12, no. 2, 1937, pp. 165–190. Results of experimental and theoretical studies of effect of dimensions and shapes of piezometric apertures in channel wall on pressure indications of piezomzometers, showing that errors vary as square of velocity and as first power of diameter of aperture. (In German.)

Pumps, Standards. Standards of Hydraulic Institute. New York City, Hydraulic Institute, 1937. 155 pp., figs., diagrs., charts, tables. $1. Classification and applications of pumps; contract form recommended for use in pump industry; standards and test codes for centrifugal, rotary, reciprocating, and deep well turbine pumps; friction tables for water; resistance of valves and fittings; friction of oil in pipe lines; friction of paper stock in cast-iron pipe; steel flange fittings and flanges; materials for pumping various liquids; properties of water at various temperatures.

Rivers. Flussquerschnitt und Profilradius, R. Winkel. *Bautechnik*, vol. 14, no. 50, Nov. 20, 1936, pp. 721–723. Theoretical discussion of relation between cross-section of river and its hydraulic radius, introducing concept of "buckled cross-section" for river bends.

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HYDROLOGY AND METEOROLOGY

Evaporation. Ein Verfahren zur graphischen Darstellung der Abhaengigkeit der Verdunstung von der Oberflaeche der Stromgebiete von der Luftemperatur, etc., P. Kusin. *Wasserwirtschaft u. Technik*, vol. 29, no. 23, Aug. 15, 1936, pp. 221–225. Study of Russian hydrological data and graphical method of representing relation between evaporation from watershed and prevailing air temperature; use of method for computation of average stream flow confirmed by data.

Lakes, Level Fluctuations. Cycles of Great Lakes: Discussion of Possible Causes of Changing Lake Elevations, S. M. Wood. *Associated State Eng. Soc.—Bul.*, vol. 11, no. 4A, Oct. 1936, pp. 83–102. Study of long range level fluctuations of Great Lakes of North America and of African lakes and their relation to sunspot cycles; control factors of freshwater lakes; general decline in lake elevation; effect of cold winters; rainfall and evaporation; variation of solar radiation; record of River Nile.

Rain and Rainfall. Zur Frage der Uebertragbarkeit von Regenbeobachtungen, H. Lohff. *Gesundheits-Ingenieur*, vol. 59, no. 50, Dec. 12, 1936, pp. 738–740. Observations on rainfall intensities in some German cities as affected by duration and by seasonal factors; comparison of winter and summer rainfall intensity curves for Mainz, Germany.

LAND RECLAMATION AND DRAINAGE

Bibliography. Bibliography on Land Drainage. Compiled by D. W. Graf. U. S. Dept. Agriculture, Bureau of Agricultural Engineering, 1936. 245 pp. International bibliography arranged by subjects and geographical division, including author index.

Mexico. La Bonificacion y la Reforestacion de los Terrenos del antiguo Lago de Texcoco, F. J. Sanchez. *Revista Mexicana de Ingenieria y Arquitectura*, vol. 15, no. 2, Feb. 1937, pp. 96–120. Improvement and reforestation of lands of ancient Texcoco Lake, for utilization of land, and as means of diminishing annoyance of unhealthy dust storms; report on progress of reclamation work; washing soil with drainage canal waters and sewage dissolves out objectionable niter; after second washing, alfalfa and grains can be grown to some extent; other experimental planting under way.

MATERIALS TESTING

Columns, Steel, Buckling. Untersuchung ueber die Knickfestigkeit von gestossenen Stuetzen, etc., G. Bierett and G. Gruening. *Deutschen Ausschusses fuer Stahlbau—Ber Ausgabe B*, no. 6, 1936, pp. 1–12. Experimental study at German Materials Testing Bureau of Dahlem, near Berlin, on buckling strength of built up columns of crosswise section having face-milled contact butts under axial and eccentric loadings.

Concrete Testing. Effect of Curing Conditions on Strength of Concrete Test Specimens Containing Burnt Clay Aggregates, W. F. Kellermann. *Pub. Roads*, vol. 18, no. 3, May 1937, pp. 53–58 and 61. Report on supplementary series of laboratory tests under controlled curing conditions (see *Public Roads*, December 1931); percentages of original mixing water remaining in concrete specimens after curing; effect of period and type of curing and non-uniform moisture distribution on flexural strength; relations between age and strength of haydite and limestone concrete specimens cured in various ways.

Road Materials, Testing. Results of Cooperative Tests Using Los Angeles Abrasion Machine, D. O. Woolf. *Highway Research Board—Proc.*, vol. 16, mtg., Nov. 18–20, 1936, pp. 174–180, and (discussion) 180. Résumé of 18 tests made by cooperating laboratories on sample of crushed limestone of uniform quality to study effect on test result of differences in design and operation of machines.

Soils. Bearing Values of Soils, F. N. Kneas. *Franklin Inst.—J.*, vol. 223, no. 4, Apr. 1937, pp. 443–462. Scale of soil compressibilities; studies of soil structure; findings as to distribution of stress into soil; interpretations of tests on fundamentally different types of soil; elastic and inelastic settlement; proportionate amounts of stress at different depths under load; drop penetration test devised by writer for estimating comparative bearing values of soils; bearing tests on clay soil; influence of tension in clay soil bearings.

PORTS AND MARITIME STRUCTURES

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France. Compte rendu de la situation des travauz maritimes dans les ports de France. *Annales des Ponts et Chaussees*, vol. 106, no. 11, Nov. 1936, pp. 563–582. Review of present status of new construction in principal ports of France.

Italy. Recentiricerche e sviluppi nel campo dei lavori portuali in Italia, E. C. Cagli. *Ingegnere*, vol. 15, no. 11, Nov. 1936, pp. 535–549. Review of Italian research on construction of vertical face breakwaters; new heavy port construction in Naples, Catania, Genoa, and Venice.

Management. Some Considerations of Problems Affecting Port Management, L. A. P. Warner. *Inst Transport—J.*, vol. 18, no. 5, Mar. 1937, pp. 195–200, (discussion) 201–206. New dock construction; dock reconstruction; grouping of ports; working hours; warehousing requirements.

Marine Borers. Der Bohrwurmbefall an Holzbauten in den Cuxhavener Haefen, Windolf. *Werft-Reederei-Hafen*, vol. 17, no. 24, Dec. 15, 1936, pp. 404–408. Attacks of marine borers on wooden structures in harbors of Cuxhaven, Germany; illustrated discription of wood decay caused by these worms, and tabulation of results of investigations.

Seawalls, Great Britain. Hove Sea Wall, H. M. Collins. *Civ. Eng. (London)*, vol. 31, no. 366, Dec. 1936, pp. 419–421. Design and con-

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struction of new stepped face concrete seawall about 17 ft maximum height, 1,320 ft long, costing about 28,300.

ROADS AND STREETS

Asphalt. Asphalt Surface Treatment of Waterbound Surfaces. *Eng. & Contract Rev.*, vol. 50, no. 32, Aug. 5, 1936, pp. 709–711. Specifications covering various types of asphaltic road construction recently issued by Asphalt Institute.

Concrete. Surface Scaling of Concrete Roads. *Contractors and Engrs. Monthly*, vol. 34, no. 5, May 1937, pp. 27 and 49. Causes and measures which have proved effective in checking surface deterioration of concrete roads; importance of curing; effect of improper finishing; shrinkage; winter damage.

Curves. Safe Side Friction Factors and Superelevation Design, J. Barnett. *Highway Research Board—Proc.*, vol. 16, mtg. Nov. 18–20, 1936, pp. 69–76, and (discussion) 76–80. Results of about 900 road tests dealing with curvature lead author to propose that highways be superelevated to counteract centrifugal force for speed of three-fourths assumed design speed; results to be expected are aiding slow vehicles without penalizing faster traffic, safer driving in slippery weather, and greater uniformity of design.

Erosion. Roadside Erosion Control Studied by Soil Conservation Service, A. Davis. *Eng. News-Rec.*, vol. 118, no. 15, Apr. 15, 1937, pp. 554–555. Description of demonstration operations in progress on two Arkansas highways expected to develop definite practices for preventing destructive wash.

Highway Engineering, United States. Trends in Highway Construction, T. H. MacDonald. *Constructor*, vol. 19, no. 4, Apr. 1937, pp. 26–28. Discussion of changes in design standards for meeting safety requirements; changes in design and specifications and in construction methods to make full utilization of new technical knowledge; application of advance planning of highway system.

Highway Systems, Michigan. Getting Rid of Road Zigzags in Michigan Highways, M. D. Van Wagoner. *Eng. News-Rec.*, vol. 118, no. 15, Apr. 15, 1937, pp. 552–554. Recent construction of three diagonal trunk highways; cutting across checkerboard of section line roads to provide short cuts for road from metropolitan area of Detroit to northwestern playground of state, Chicago-to-Montreal road through Michigan, and direct route between Holland, Mich., and Toledo, Ohio.

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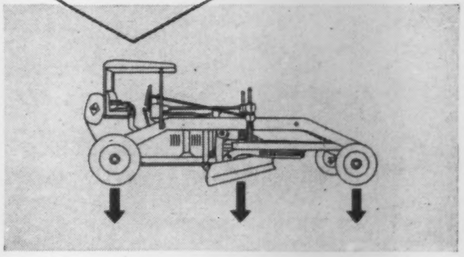

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The new weld symbols occupy sixteen pages in the reprinted Handbook. The symbols are reproduced in toto as adopted by the Welding Society. The symbols are ideographic and their use, as applied to welded design drawings, is fully explained. In addition to the symbols themselves, an example is given of how the symbols are actually applied in producing a welded design.

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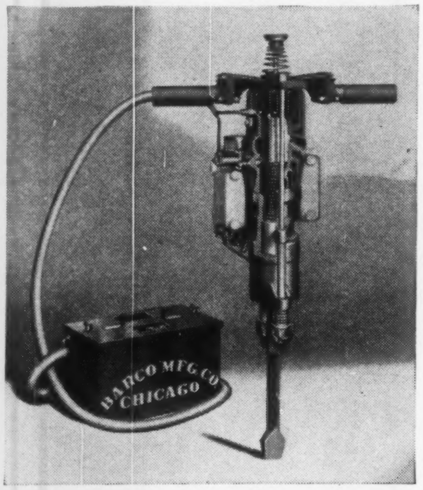

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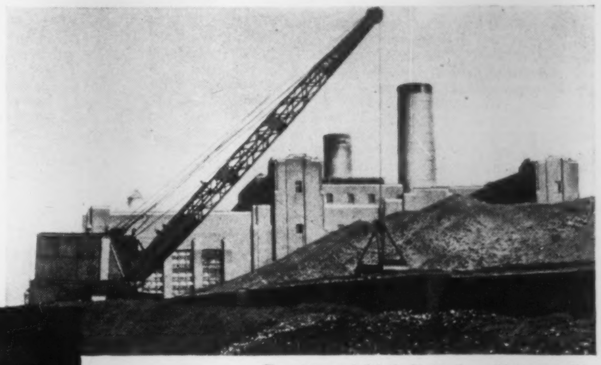

Courtesy of Link-Belt Co., Chicago, Ill.

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APPLICATIONS

of the Nickel Alloy Steels in excavating and material handling equipment

Racks, booms, sheaves
Upper and lower frames
Rollers, Large gears
Pinions and sprockets
Crawler parts
Hoist and drive gears
Hoist drum shafts
Shipper shafts
Track pins
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BRIDGES

Brick. Brick Masonry in State Highway Bridges in Ohio. J. C. Merrell. *Am. Cer. Soc.—Bul.*, vol. 16, no. 4, Apr. 1937, pp. 135–138. Review of brick structures of past and uses of brick in present-day structures; reinforced brick structures for acid-carrying streams and for highway bridges.

Concrete Arch, France. La reconstruction du pont du Carrousel sur la Seine à Paris, P. Levy. *Technique Moderne*, vol. 29, no. 8, Apr. 15, 1937, pp. 257–264. Reconstruction of Carrousel Bridge over Seine River in Paris; theoretical study of bridge and its method of support during concreting; method of concrete placing; bridge is of concrete arch type, with center span of 42.6 m and two spans of 35.91 m, at 4.06-m rise.

Concrete Frame, Seattle, Wash. Record Rigid-Frame Bridge, J. A. Dunford. *Eng. News-Rec.*, vol. 118, no. 25, June 24, 1937, pp. 939–942. Design and construction of rigid-frame concrete bridge, of 175-ft span, recently completed across deep, narrow ravine in Schmitz Park, Seattle; details of leg members of rigid frames, featured by hollow construction and haunched outline.

Floors. Thin Concrete Bridge Floor Wears but Little in 10 Years, G. W. Buck. *Eng. News-Rec.*, vol. 118, no. 19, May 13, 1937, pp. 710–711. Observations on performance of reinforced concrete floor, 4³/₄ in. thick, of Burnside Bridge across Willamette River in Portland, Ore.

Masonry Arch, Maintenance and Repair. Old Waterloo Bridge: Schemes for Reconditioning and Widening, R. P. Mears. *Structural Engr.*, vol. 15 (new series), no. 4, April 1937, pp. 160–181, 2 supp. sheets. Discussion of several schemes proposed for reconditioning and widening of bridge completed in 1817, consisting of nine masonry arches, each of 120-ft span, supported by eight piers, 20 ft thick, and two end abutments. Before Instn. Structural Engrs.

Masonry Arch, Widening. Widening of Richmond Bridge. *Engineer*, vol. 163, no. 4240, Apr. 16, 1937, pp. 443–446. Bridge, as it stands today, consists of five stone arches and is approached on each side by viaduct carried by low arches; it is to be widened to provide 21-ft roadway and two footpaths 7 ft 6 in. in diameter; how work of widening bridge is to be carried out.

Plate Girder, Construction. Falsework on Wheels Places Railroad Bridge in Halves. *Construction Methods*, vol. 18, no. 6, June 1936, pp. 30–33. Bridge replacement on Central Railroad of New Jersey at Newark, N.J., using timber falsework traveling on wheels to carry completely assembled halves of new six-track, 1,050-ton steel plate-girder railroad bridge with concrete deck; temporary track changes during demolition and replacement of bridge.

Railroad, Denmark. Longest Bridge in Europe, R. G. Skerrett. *Compressed Air Mag.*, vol. 42, no. 5, May 1937, pp. 5319–5324. Features of Storstroem Bridge, built to speed railway travel between Copenhagen and principal cities that lie to south in western Europe; bridge is 10,532 ft long between terminal abutments and is carried on 51 piers; details of construction, with special references to use of compressed air.

Steel Arch. Jacking Devices Control Rib Stresses During Erection and Closing of 800-Ft Hingeless Arch. *Construction Methods*, vol. 18, no. 12, Dec. 1936, pp. 28–31. Jacking devices used in erection of 800-ft main span of Henry Hudson Bridge across Harlem River, New York City; details of closure operations.

Steel, Canada. Some Recent Canadian Steel Bridges, R. C. Manning. *Can. Engr.*, vol. 72, no. 14, Apr. 6, 1937, pp. 7–9 and 18. Review of some of outstanding points of interesting structures erected during past few years; possibility of widening, strengthening, or moving steel bridges; esthetics of design.

Steel, Germany. New German Bridges, G. Schaper. *Structural Engr.*, vol. 15 (new series), no. 5, May 1937, pp. 209–229. Review of modern German practice in design of steel-truss and plate-girder bridges, with special reference to new bridges along system of superhighways now in course of construction and two bridges serving Ruegen causeway; use of high tensile steel; application and advantages of welding to bridge construction. Before Instn. Structural Engrs. and Instn. Civ. Engrs.

Steel Truss. High, Continuous Truss Bridge Erected by C.C.C. Crews. *Eng. News-Rec.*, vol. 118, no. 25, June 24, 1937, pp. 947–948. Erection of bridge of 160-ft central span, 125 ft above Trinity River in California, by inexperienced workmen under skilled direction; truss assembly; cantilever erection; floor construction.

Suspension, Golden Gate. Welding and Cutting Play Important Rôles in Construction of Golden Gate Bridge, E. L. Mathy. *Welding Engr.*, vol. 22, no. 6, June 1937, pp. 22–25. Few of essential factors in order to more fully appreciate vast magnitude of bridge, as well as its great importance in mighty highway system; welding cuts costs in making pilot bombs; shop and field welding used in constructing pier fenders; scrap transformed into useful gadgets by cutting and welding.

Suspension, Guatemala. Self-Anchored Eye-Bar Cable Bridge, C. B. McCullough and R. Archibald. *Eng. News-Rec.*, vol. 118, no. 24, June 17, 1937, pp. 912–913. Design and construction of Rio Tamasulapa, Guatemala, suspension bridge of 240-ft main span, in which interesting Mayan architectural details are incorporated; construction of foundations.

BUILDINGS

Apartment Houses, Great Britain. Reinforced Concrete Residential Flats. *Concrete & Constr. Eng.*, vol. 32, no. 3, Mar. 1937, pp. 212–217. Structural and architectural features of several new British apartment houses, four to ten stories high; control of temperature; floors and ceilings; roofs; corridors, balconies, and staircases; finishes on outer walls.

Schools, Earthquake Resistance. Flat Slabs on 25-Ft Spans in Earthquake-Resistant School, H. B. Hammill. *Eng. News-Rec.*, vol. 118, no. 24, June 17, 1937, pp. 918–919. Design of concrete floors, walls, roofs, and columns acting as rigid-frame units to resist earthquake force; concrete framing of flat slabs; moment diagrams for column and second-floor slab under vertical loads; architectural treatment.

Wind Effect. Wind Stresses in Multi-Story Buildings, R. Gray. *Structural Engr.*, vol. 15 (new series), no. 5, May 1937, pp. 186–208. Theoretical discussion of wind pressure to be allowed; computation of moments, shears, and thrusts induced in members; selection of suitable members; connections; uplift on foundation blocks.

CITY AND REGIONAL PLANNING

Comparisons. Housing and Planning, R. Unwin. *Roy. Soc. Arts—J.*, vol. 85, no. 4413, June 18, 1937, pp. 716–724, (discussion) 724–728. English and American practice compared.

Housing, Great Britain. Housing and Slum Clearance in Leeds, R. A. Livett. *Roy. Inst. Brit. Architects—J.*, vol. 44, 3d series, no. 15, June 5, 1937, pp. 765–778. Report on recent development of several housing estates; fabrication of vibrated concrete units; use of pre-cast members and welding methods.

New York. Reclaiming Riverfront. *Eng. News-Rec.*, vol. 118, no. 23, June 10, 1937, pp. 863–869. Changes along Hudson River shore line, involving track covering, express highway building, and park development along 7-mile front; construction of pre-cast beam retaining wall.

Soils, Mapping. Bodenkundliche Kartierung fuer Siedlung und Landesplanung, M. Trenel. *Zeit fuer praktische Geölogie*, vol. 45, no. 2, Feb. 1937, pp. 19–27. Soil mapping for purposes of colonization and regional planning discussed.

CIVIL ENGINEERING

Literature Classification. Indexing and Filing of Technical Literature, H. N. Bassett. *Soc. Chem. Industry—J. (Chem. & Industry)*, vol. 56, no. 20, May 15, 1937, pp. 463–465. Method described of dealing with technical data has proved adaptable to wide variety of subjects; use of cards claimed to be only possible way in which constantly growing index can be kept; system that has stood test of 20 years with writer is vertical filing of thin cards in ordinary foolscap folders.

CONCRETE

Columns, Design. Economical Use of Reinforcement in Columns, E. E. Hendriksen. *Concrete & Constr. Eng.*, vol. 32, no. 2, Feb. 1937, pp. 111–116. Method of adjusting concrete column design to make full use of reinforcement; correction for direct stress; variation in modular ratio; example.

Construction, Earthquake Resistance. Earthquakes and Reinforced-Concrete, J. J. Creskoff. *Am. Concrete Inst.—J.*, vol. 8, no. 3, Jan.–Feb. 1937, pp. 223–249. Earthquakes in United States; seismic cycles; ground vibrations; structural vibrations; earthquake damage; aseismic design; dynamical vs. statical design; rigid vs. flexible design; cost of aseismic construction; reinforced concrete in aseismic design; reinforced concrete in damping vibrations; reinforced concrete in floors and walls; reinforced concrete in controlling amplitude. Bibliography.

Construction, Europe. Notes on Inspection of Structures in Europe, A. J. Boase. *Am. Concrete Inst.—J.*, vol. 8, no. 5, May–June 1937, pp. 521–540. Notes on construction of pile foundation of Marine Station of Havre Harbor, France, using Freyssinet "treated concrete"; description of new long-span hollow-membered concrete bridges; continuity in buildings; architectural concrete; industrial and commercial buildings.

Disintegration. Deterioration of Concrete in Normal Service, D. L. Snader. *Columbia Univ.—Civ. Eng. Research Laboratories*, no. 5, February 1937, 45 pp. Results of 10-year study of resistance of concrete to forces causing deterioration and nature and extent of these forces; studies and tests of samples of concrete; conditions of penetrating water; disintegration at water line.

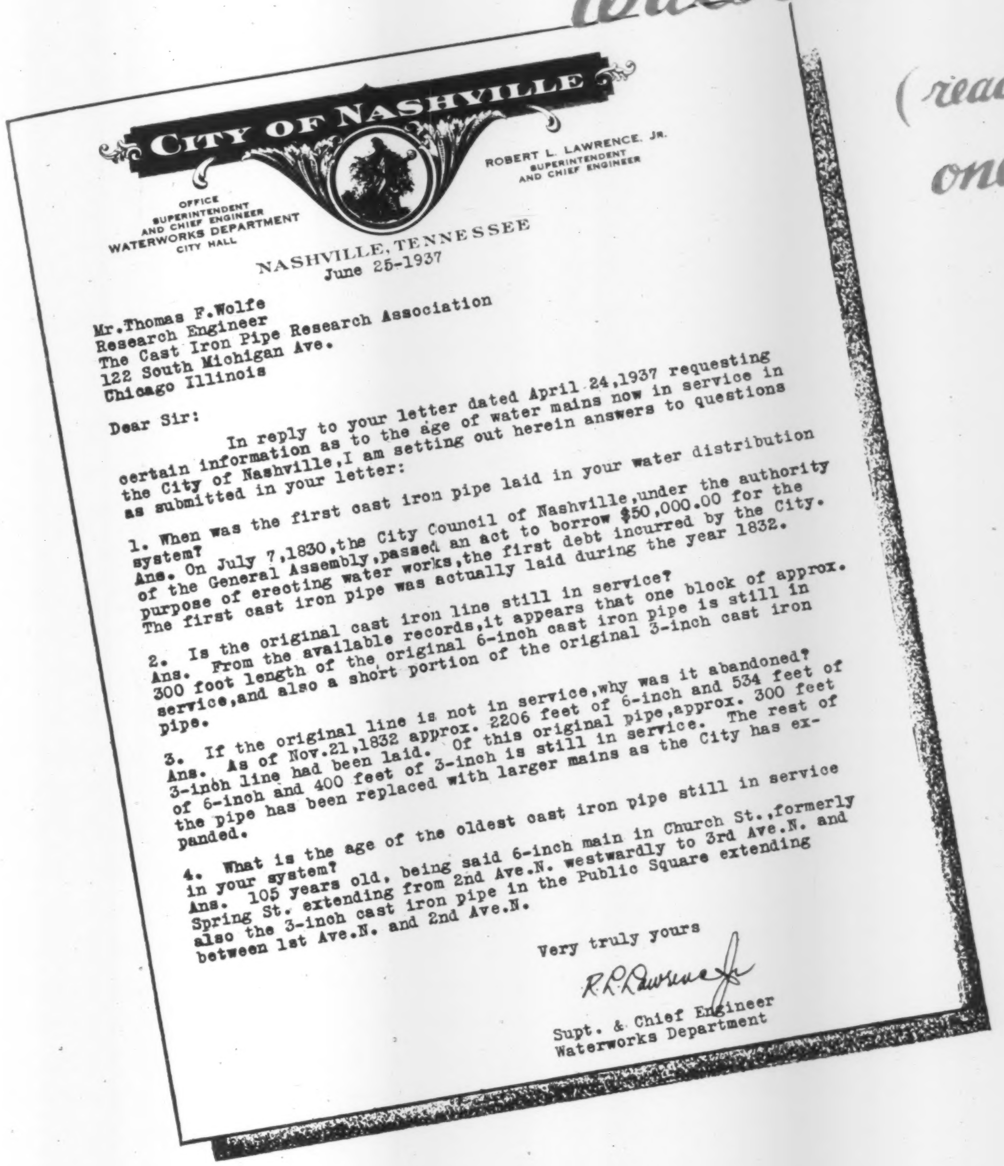
Floors. Hung Forms for Floor Slabs, K. B. Humphrey. *Eng. News-Rec.*, vol. 119, no. 1, July 1, 1937, pp. 34–35. Description of suspended form used in floor construction where ceiling height of 34 ft and obstructions below made shoring from ground expensive.

Shrinkage. Drying Shrinkage of Large Concrete Members, R. W. Carlson. *Am. Concrete Inst.—J.*, vol. 8, no. 3, Jan.–Feb. 1937, pp. 327–336. Theoretical and experimental study, conducted at Massachusetts Institute of Technology, since 1934, on volume change in concrete members of varying size; evaluation of moisture diffusion constant; average rates of drying of concrete slabs; computed distribution of drying in massive concrete structures; percentage of evaporable moisture remaining in drying slabs at various depths from drying surface.

Testing. Das elastische Verhalten von Beton K. Eisenmann. *VDI Zeit.*, vol. 81, no. 19, May

A letter of interest to water works men

(reading time one minute)



CITY OF NASHVILLE

OFFICE
SUPERINTENDENT
AND CHIEF ENGINEER
WATERWORKS DEPARTMENT
CITY HALL

ROBERT L. LAWRENCE, JR.
SUPERINTENDENT
AND CHIEF ENGINEER

NASHVILLE, TENNESSEE
June 25-1937

Mr.Thomas F.Wolfe
Research Engineer
The Cast Iron Pipe Research Association
122 South Michigan Ave.
Chicago Illinois

Dear Sir:

In reply to your letter dated April 24,1937 requesting certain information as to the age of water mains now in service in the City of Nashville,I am setting out herein answers to questions as submitted in your letter:

1. When was the first cast iron pipe laid in your water distribution system?
Ans. On July 7,1830,the City Council of Nashville,under the authority of the General Assembly,passed an act to borrow $50,000.00 for the purpose of erecting water works,the first debt incurred by the City. The first cast iron pipe was actually laid during the year 1832.

2. Is the original cast iron line still in service?
Ans. From the available records,it appears that one block of approx. 300 foot length of the original 6-inch cast iron pipe is still in service,and also a short portion of the original 3-inch cast iron pipe.

3. If the original line is not in service,why was it abandoned?
Ans. As of Nov.21,1832 approx. 2206 feet of 6-inch and 534 feet of 3-inch line had been laid. Of this original pipe,approx. 300 feet of 6-inch and 400 feet of 3-inch is still in service. The rest of the pipe has been replaced with larger mains as the City has expanded.

4. What is the age of the oldest cast iron pipe still in service in your system?
Ans. 105 years old, being said 6-inch main in Church St.,formerly Spring St. extending from 2nd Ave.N. westwardly to 3rd Ave.N. and also the 3-inch cast iron pipe in the Public Square extending between 1st Ave.N. and 2nd Ave.N.

Very truly yours

R.L.Lawrence Jr

Supt. & Chief Engineer
Waterworks Department

We have asked Nashville and 211 other cities whether *original cast iron mains* in their water distribution systems were still in service. Mr. Lawrence's letter (reproduced by permission) is typical of 203 others out of 212—96 percent—whose answers were—*yes.* Only a material with great *bursting* strength, *beam* strength, *crushing* strength, *impact* strength, and *effective corrosion resistance*—indispensable requirements of an underground water main—can render such enduring and economical service.

THE CAST IRON PIPE RESEARCH ASSOCIATION

Thomas F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois

8, 1937, pp. 541–543. Elastic behavior of concrete; tests made at Institute of Technology in Braunschweig, regarding precision measurements with micro-comparator, show that elastic processes in concrete are much more involved, as would be indicated by experiments of Bach and Schule; theory development on basis of these experiments.

WORKABILITY. Workability of Concrete and Mortars, E. W. Scripture. *Eng. News-Rec.*, vol. 119, no. 1, July 1, 1937, pp. 17–21. Director of Master Builders Research Laboratories, Cleveland, Ohio, discusses flow-shear conception, differences between workable and non-workable concretes, desirable qualities, rôles of mix components, finely divided admixtures, effect of additional materials, effect of soaps, glue, tannin, sugar, and dispersing agents. Bibliography.

WORKABILITY, STUDY. Grading and Workability, W. H. Glanville. *Am. Concrete Inst.—J.*, vol. 8, no. 3, Jan.–Feb. 1937, pp. 319–326. Theoretical and experimental study of measurement of workability; compacting factor test; theoretical relation between compacting factor and applied work; effect of presence of fine material on workability of concrete.

CONSTRUCTION INDUSTRY

COSTS. Contract Unit Prices. *Eng. News-Rec.*, vol. 118, no. 24, June 17, 1937, p. 926, and (adv. sec.) p. 24. Unit costs bid on construction of sea-water intake for water-softening plant, South Carolina; siphon pipe crossing, All-American Canal, California; asphalt surfacing, Arizona; and Connecticut River Bridge, Massachusetts.

Contract Unit Prices. *Eng. News-Rec.*, vol. 118, no. 25, June 24, 1937, p. 966, and (adv. sec.) p. 28. Average prices on Kentucky roads, 1934–1937; unit costs bid on construction of concrete surfacing, Washington; highway bridge, Washington; San Gabriel Dam spillway; Merrimac River Bridge, New Hampshire.

DAMS

ARCH STRESSES. Arch Deflections and Temperature Stresses in Curved Dams, I. E. Houk. *Engineer*, vol. 163, nos. 4238 and 4239, April 2, 1937, pp. 382–384 and April 9, pp. 414–415. Apr. 2: Temperature stresses in horizontal elements of arch dams; April 9: Arch deflections at crown cantilevers of curved concrete dams.

CONCRETE ARCH, AUSTRALIA. Distortion Measurements at Ingleburn Multiple Arch Dam, H. H. Thomas. *Instn. Engrs. Australia—J.*, vol. 8, no. 12, Dec. 1936, pp. 479–484. Precise surveying methods used in measuring deflections of largest arch and two largest buttresses (maximum height 40 ft) of Ingleburn multiple-arch concrete dam; summary of movements, thrusts, and shear. Bibliography.

CONCRETE GRAVITY, SOUTH AFRICA. Vaal River Development Scheme. *Engineer*, vol. 163, no. 4239, Apr. 9, 1937, pp. 409–412 and 420. Immediate expenditure provides for storage dam below Wilge River infall and irrigation scheme in Hartz River valley; cost estimated at £4,000,000; work consists of concrete dam of overspill gravity type; details of outlet valves, crushing plant, and cableways; earth embankment; diversion weir, etc.

CONSTRUCTION. Planning and Plant for Heavy Construction—IX and X, A. J. Ackerman and C. H. Locher. *Construction Methods*, vol. 18, nos. 8 and 9, August 1936, pp. 46–49, and September, pp. 44–47. Diversion of rivers; diversion tubes and channels; Saguenay River diversion; making final closure.

EARTH, CONSTRUCTION. Pneumatic-Tired and Track-Mounted Earth Movers Haul Materials for Rolled Earth-fill Dams at 13 Muskingum Valley Reservoirs—I and II. *Construction Methods*, vol. 18, nos. 11 and 12, Nov. 1936, pp. 28–32, and Dec., pp. 36–37 and 40–41. Construction of project estimated to cost almost $38,000,000; design of earth dams; embankment design; outlet works and spillways; embankment materials; methods of construction; typical job layouts.

EARTH, FAILURE. Small Earthfill Dam Fails. *Eng. News-Rec.*, vol. 118, no. 25, June 24, 1937, p. 932. Failure of Fruit Growers Reservoir Dam on Gunnison River near Austin, Colo.; dam, built in 1898, was 36 ft high, 910 ft long.

EARTH, STABILITY. Approximate Determination of Stability of Earth Dams, R. R. Chugayev. *Izvestiya Nauchno-Issledovatelskovo Instituta Hydrotechniki*, no. 18, 1936, pp. 203–216. Theoretical mathematical discussion based on principles of soil physics, with special reference to percolation of water through earth bodies. Before 2d Congress on Large Dams (in Russian).

RESERVOIRS, ARIZONA. Desert Water Tanks, G. G. Sykes. *Eng. News-Rec.*, vol. 119, no. 1, July 1, 1937, pp. 36–37. Old Arizona practice of storing water in artificial reservoirs filled with gravel and sand, minimizing loss by evaporation.

RESERVOIRS, CONCRETE. Reservoir at Tamworth, J. C. Radford. *Concrete & Constr. Eng.*, vol. 32, no. 1, Jan. 1937, pp. 54–58. Design and construction of new covered reinforced concrete distribution reservoir at Tamworth, England, having capacity of $1^1/_2$ million gallons; vibration of concrete; summary of tests.

ROCK FILL, SOVIET UNION. Damming of River Channels with Rock Fill Without Lateral By-Passing, V. E. Domansky. *Izvestiya Nauchno-Issledovatel'skovo Instituta Hydrotechniki*, no. 19, 1936, pp. 241–251. Design and construction of rock-fill dam, 29 m high, 223,000 cu m in volume, over Tuloma River, in Kola Peninsula, near Norwegian border of USSR, by dumping rock into stream from both banks and subsequently dressing upstream face with impervious soil blanket. (In Russian, with English abstract, pp. 250–251.)

SPILLWAYS. Bellmouthed Weirs and Tunnel Outlets for Disposal of Flood Water, W. J. E. Binnie. *Water & Water Eng.*, vol. 39, no. 480, Midsummer 1937, pp. 335–349. Description of seven shaft spillways in British Empire and in United States; comparison of model with prototype; effect of entrained air; influence of fins, radial piers, and curtain wall; design of shaft spillway for Jubilee Reservoir at Hong Kong, having capacity of 11,330 cu ft per sec. Before Instn. Water Engrs.

FLOOD CONTROL

CANADA. Water Supply and Sewage Disposal to Be Aided by Flood Control Measures on Grand River, F. P. Adams. *Eng. & Contract. Rec.*, vol. 50, no. 55, Jan. 13, 1937, pp. 19–22. Outline of flood-control scheme for Grand River watershed, north of Lake Erie, having area of 2,600 sq miles, including four reservoirs; water supply and sewage disposal; reforestation. Before Can. section of Am. Water Works Assn.

LOS ANGELES, CALIF. Checking Torrential Floods. *Eng. News-Rec.*, vol. 119, no. 1, July 1, 1937, pp. 22–24. Development of present $70,000,000 flood-control program for Los Angeles County, involving construction of 15 storage dams; progress; rainfall and runoff data; federal control.

FOUNDATIONS

BRIDGE PIERS. Wellpoints on Small Bridge Work, L. Grover. *Eng. News-Rec.*, vol. 118, no. 23, June 10, 1937, pp. 877–879. Use of wellpoints in place of more conventional foundation methods on several Kansas bridges across Republican River in northern part of state, bridge at Goodland, and railroad grade-separation project at Lawrence; excavation in circular steel-plate cofferdam protected by ring of wellpoints.

BRIDGE PIERS, BEARINGS. Determination of Coefficients of Friction of Sliding Bearings for Bridges, G. W. Davis. *Pub. Roads*, vol. 17, no. 10, Dec. 1936, pp. 223–237. Results of experimental study by Division of Tests, U. S. Bureau of Public Roads; chemical composition and physical characteristics of bronzes, steel, and iron tested; study of unlubricated, lubricated, and rusted plates; effect of surface finish on magnitude of coefficient of friction; effect of direction of movement; combinations of like or unlike ferrous materials; exposure to calcium chloride and sodium chloride.

COFFERDAMS. Planning and Plant for Heavy Construction—VII and VIII, A. J. Ackerman and C. H. Locher. *Construction Methods*, vol. 18, nos. 6 and 7, June 1936, pp. 50–54, and July, pp. 46–49. Cofferdam design and construction, including earth-fill, rock-fill, continuous wood-frame, and crib types; concrete wall, steel sheet-pile, and cellular steel types of cofferdams.

COFFERDAMS, CONSTRUCTION. Contractors Win River Battle. *Eng. News-Rec.*, vol. 119, no. 1, July 1, 1937, pp. 13–16. Method of stopping inflow of 35,000 gal per min under Grand Coulee cofferdam by grouting with special grout mixture and reconstruction of cells; causes of leak.

DESIGN. Recent Developments in Foundation Design—with Special Reference to Concrete, C. S. Proctor. *Am. Concrete Inst.—J.*, vol. 8, no. 5, May–June 1937, pp. 541–556. Review of recent progress; design of West Bay Crossing piers for San Francisco–Oakland Bay Bridge, employing newly invented Moran caisson; foundations for Mississippi River Bridge at New Orleans; support of structures for New York World's Fair; foundations for support of world's tallest structure, Palace of Soviets, in Moscow, USSR.

HOUSES. Anchored Foundations Prove Worth in Recent Floods. *Am. Bldr. & Bldg. Age*, vol. 59, no. 6, June 1937, pp. 88 and 90. Results of study of damage caused by Ohio River flood of 1937 to typical wood-frame houses in Louisville, Ky., and Jeffersonville, Ind.; suggested methods for reducing structural damage to frame construction by floods; timber-post foundation; concrete, brick, or masonry piers; continuous concrete or concrete block foundation; framing members.

LANDSLIDES, CONTROL. Steel Baffles Stop Sliding Fill, G. H. Allen. *Eng. News-Rec.*, vol. 119, no. 1, July 1, 1937, pp. 32–33. Design and construction of system of anchors and buried steel-plate slope-baffles, which have held road embankment near Troy, Ind., for 3 years without showing any signs of dangerous moving.

PILES. Recent Developments in Pile Foundations, M. M. Upson. *Am. Concrete Inst.—J.*, vol. 8, no. 5, May–June 1937, pp. 557–574. Review of recent progress in design and construction of pile foundations in Europe and in America, including descriptions of several patented types of concrete piles.

PILES, CONCRETE, TESTING. Impact Test for Piles, G. B. R. Pimm. *Concrete & Constr. Eng.*, vol. 32, no. 3, Mar. 1937, pp. 209–211. Discussion of value of impact testing of pre-cast concrete piles.

PILES, DRIVING. Planning and Plant for Heavy Construction—XI, A. J. Ackerman and C. H. Locher. *Construction Methods*, vol. 18, no. 10, Oct. 1936, pp. 44–45, and 48–51. Pile driving and extracting; unwatering cofferdams; data on pile hammers and on pile extractors; selection of pile hammers.

HYDRAULIC ENGINEERING

WATERPROOFING. Main Results of Soil Consolidation Research by Chemical Division of Construction Laboratory of Moscow—Volga Canal, A. V. Znamensky. *Izvestiya Nauchno-Issledovatelskovo Instituta Hydrotechniki*, no. 19, 1936, pp. 261–272. Experimental studies on waterproofing of canal linings and concrete walls with bitumen-sand mixes, silicate water glass compound, etc. (In Russian, with brief abstract in English, pp. 271–272.)

HYDROLOGY AND METEOROLOGY

RAIN AND RAINFALL, DROUGHT. Effect of Drought Conditions in Ontario, A. E. Berry. *Can. Engr.*, vol. 72, no. 19, May 11, 1937, pp. 18–21, (discussion) 21–22. Effect of drought on water supplies and disposal of sewage; precipitation and temperature data. Before Am. Water Works Assn., Montreal.

INLAND WATERWAYS

RIVER DIVERSION. Diversion of Columbia River—Grand Coulee Dam, O. G. F. Markhus. *Reclamation Era*, vol. 27, no. 2, Feb. 1937, pp. 30–33. Construction of cofferdams and other works for diversion of Columbia River, at site of Grand Coulee Dam, where discharge may be about 500,000 cu ft per sec.

RIVERS. Great Ouse Catchment Board—I and II, O. Borer, W. Gribbin, D. B. O'Shea, and W. F. Pattison. *Water & Water Eng.*, vol. 39, nos. 473 and 474, January 1937, pp. 10–16, and February, pp. 53–64. Work and powers of Board; reconstruction of Brownshill and St. Ives staunches; tidal model of Great Ouse and Wash; construction of model; surveys and experimental work; correlation to estuary and model; silt samples; formation and reorganization of internal drainage districts. Before Inst. Mun. & County Engrs.

RIVERS, IMPROVEMENT. Die Gailregulierung in Kaernten, H. Schuetz, and R. Wachernig. *Wasserwirtschaft u. Technik*, vol. 3, no. 28–30, Oct. 15, 1936, pp. 311–320. Review of flood control and regulation improvements on Gail River in Province of Carynthia, Austria; effect of improvements on agriculture of region; improvement of mountain torrents.

LAND RECLAMATION AND DRAINAGE

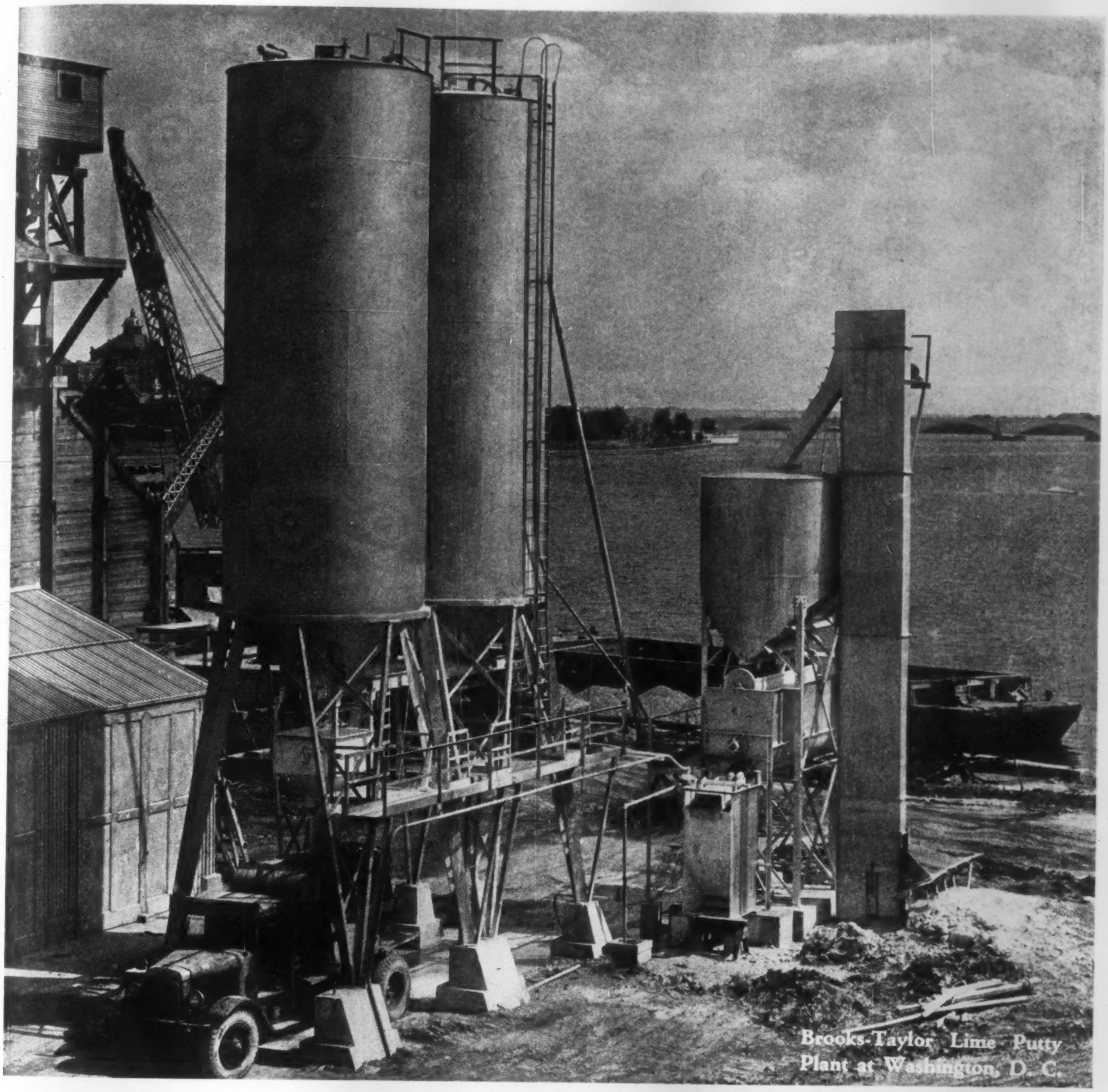
CLEVELAND, OHIO. Foundation Job Includes Moving River. *Eng. News-Rec.*, vol. 118, no. 23, June 10, 1937, pp. 880–882. Eighty-acre site of New Republic Steel Corporation rolling mill at Cleveland raised 5 ft above old level with 75,000 cu yd of fill; oxbow bend in river eliminated by cutoff; mixing slag with earth fill to secure compaction; driving 17,000 concrete piles.

WATER SUPPLY. Grundwasser und Trinkwasserversorgung im Wieringermeerpolder, E. Bachus. *Bauingenieur*, vol. 18, nos. 3/4, Jan. 22, 1937, pp. 40–41. Methods of providing underground water supply for Wieringermeer polder of Zuidersee reclamation project, Netherlands. Abstracted from *Rapporten en Mededeelingen betreffende de Zuiderzeewerken*, v 5.

MATERIALS TESTING

BRICK, PAVING. Tested Bricks for Road Paving. A. E. Blizzard. *Cer. Soc.—Trans.*, vol. 36, no. 3, Mar. 1937, pp. 98–104, (discussion) 105–109. Author defends brick as ideal road material and cites opinions of various well-known companies and individuals to substantiate his beliefs.

RESULTS. Bedeutung der Ergenbnisse der Werkstoffpruefung fuer den Konstrukteur, E.



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During the aging period, excess water is removed from the putty by means of special filters. When the putty has reached the proper consistency, the filters are closed. The putty can then be held until required for delivery.

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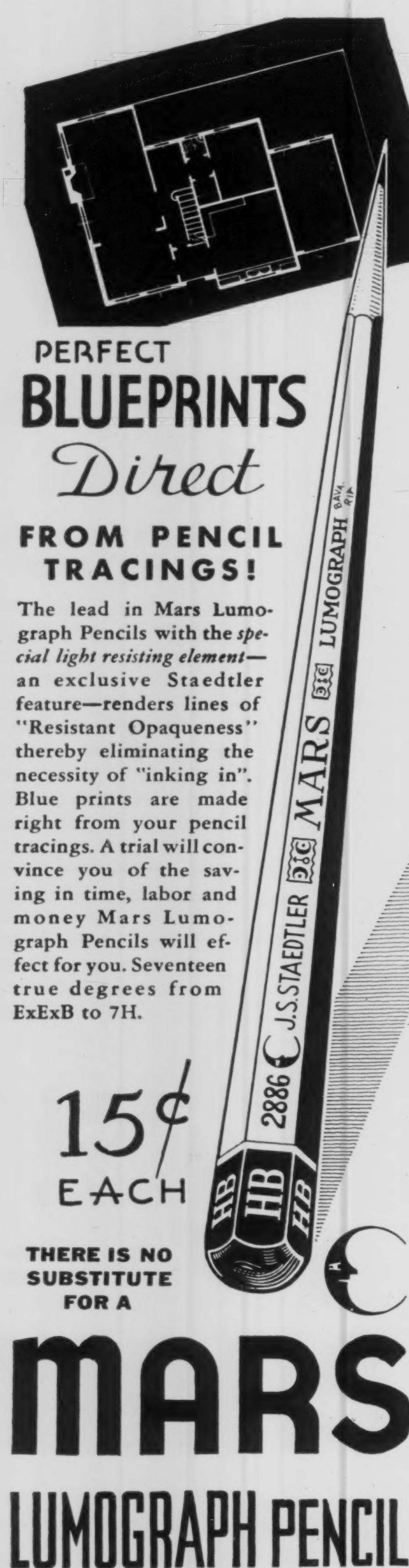

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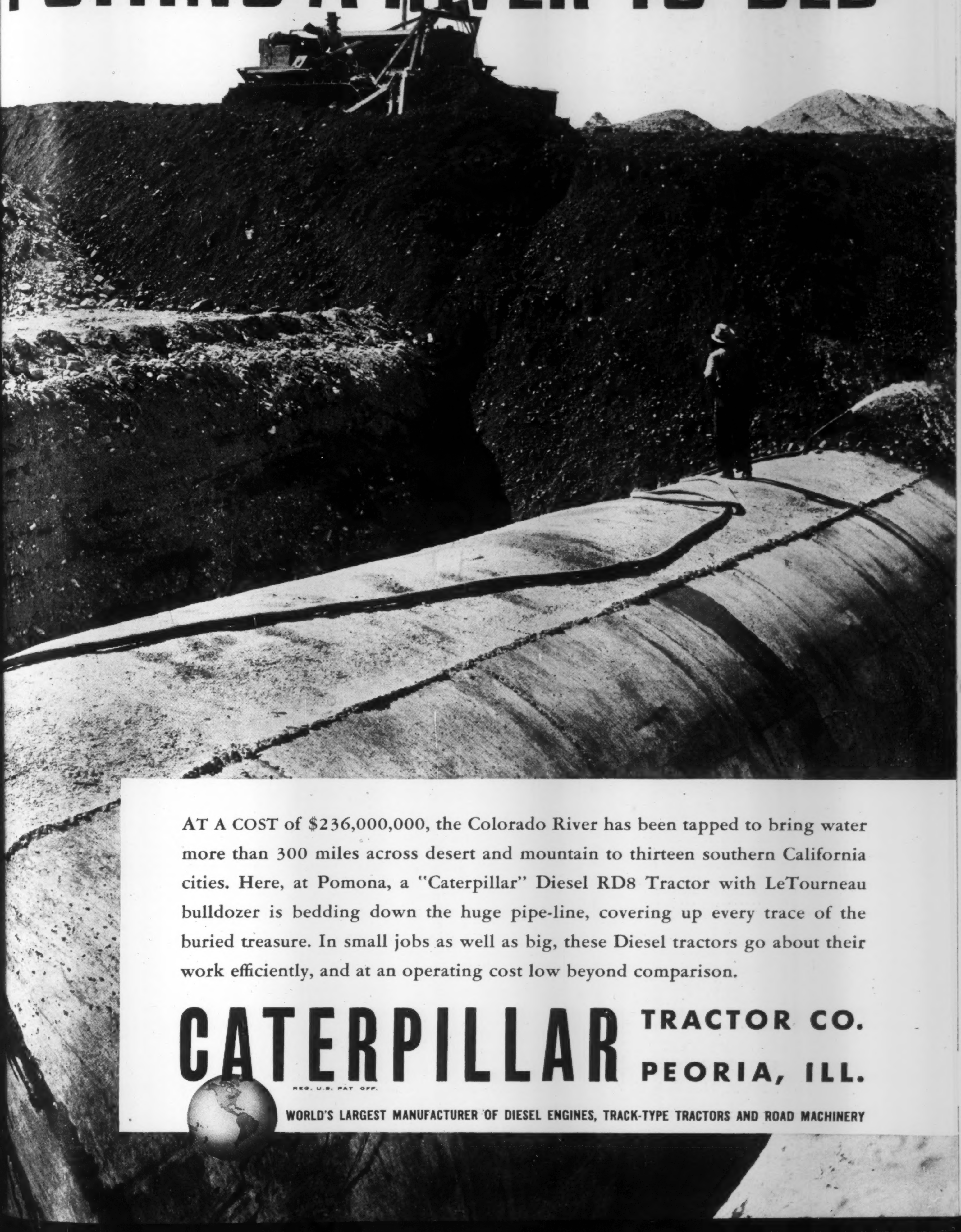

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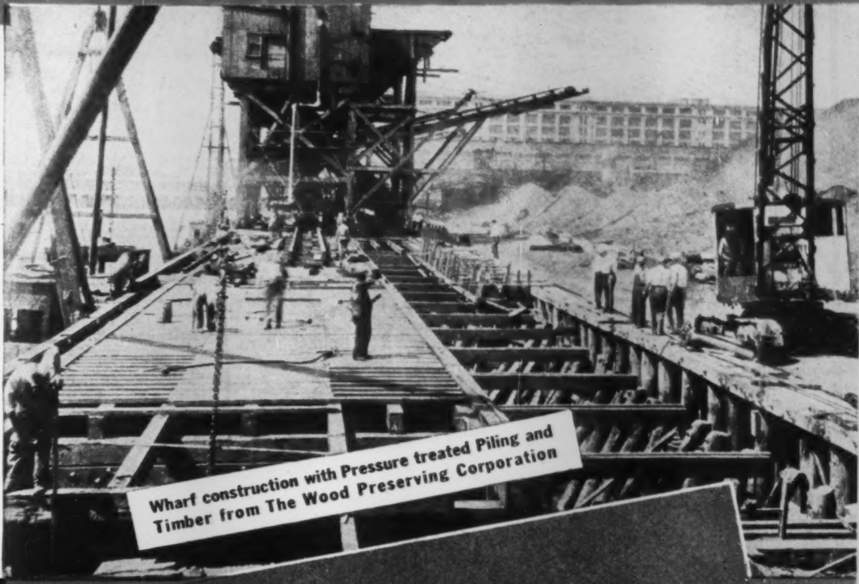
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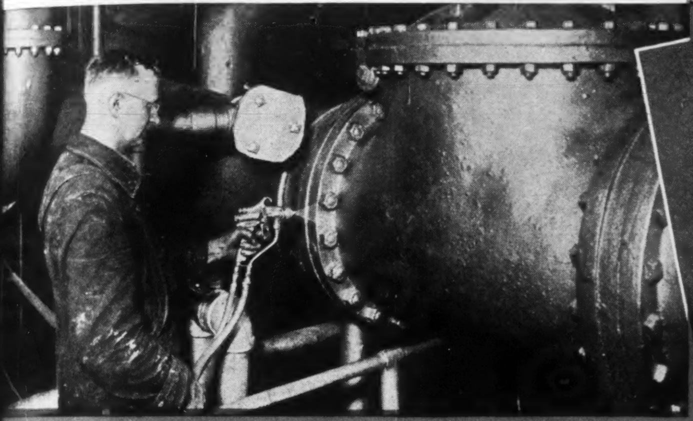

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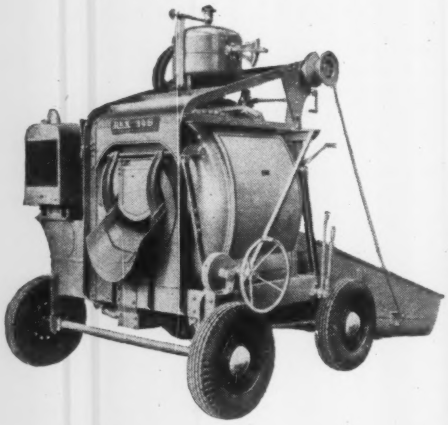


Fire Line Water Meter

THE FLOW-OM-ETER is an accurate low-cost measuring device designed for 4-in., 6-in., and 8-in. flow lines. It is offered primarily to supply the need for an economical instrument to register water used, either legally or otherwise, through fire lines. For installation, only a 2 in. tap is made on the top of the pipe. The Flow-om-eter is set and a gate box is placed over it. The Flow-om-eter is manufactured and sold by Northrop & Cook Company, 50 Church St., New York, N. Y.

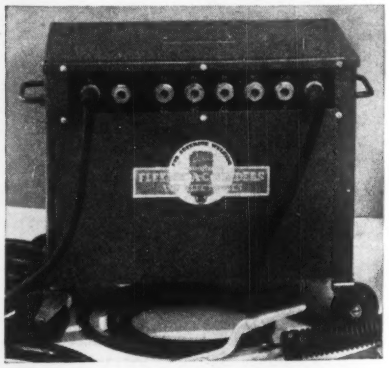
F-M Pumps

THE FAIRBANKS-MORSE line of deep-well turbine pumps with enclosed impellers are described in two new bulletins. Bulletin 6920 deals with oil lubricated units used for most applications; Bulletin 6920R covers water lubricated units, which are used where the water must be kept pure and clean and oil lubrication is not permissible. Both types, oil and water lubricated, are available in sizes from 4 to 16 in. and in capacities from 10 to 2300 gal per min with lifts to 400 ft.

Fairbanks-Morse Steam Pumps, described in Bulletin 6205, are suitable for a wide range of pumping applications. They have been designed to pump water, oil, and similar liquids at pressures up to 420 lb per sq in. in quantities up to 464 gal per min. Both the F-M General Service and Low Service steam pumps are of the duplex piston pattern type. General Service units are offered in one-piece and two-piece patterns. In most sizes of Low-Service pumps, the steam and fluid ends are cast separately, then assembled, forming the two-piece pattern.

Low Cost Welder

TO MEET the increasing need for a low cost a-c. welder for use in maintenance and repair as well as light construction work, the Westinghouse Electric and Manufacturing Company have announced the Midget Marvel A-C. Welder. This welder comprises a special transformer and control especially designed for alternating current arc welding. The new set has unusually high operating efficiency, averaging 87% at normal loads.



The welder is easily portable being equipped with handles and four large hard rubber swivel casters. The 60 cycle set weighs 112 lbs and the 50 cycle set weighs 130 lbs. Each welder is $14^{1}/_{4}$ in. high, $10^{3}/_{4}$ in. wide, and $17^{7}/_{8}$ in. long including handles. Complete accessories are included with each set and consist of welding lead with holder and current adjusting plug attached, ground lead with clamp, helmet, wire brush, supply of crucible weld electrodes, and primary lead.

SAVES $4653

IN TIME AND FORMS ON 11-STORY OFFICE BUILDING

LOOK ahead to cold weather. Plan now to take full advantage of 'Incor's dependable high early strength.

After one or two days' heat protection, 'Incor' is stronger than other concretes at 3 to 5 days. That means reduced heating expense, fewer forms, lower time or overhead costs. Example:

New England Power Building, Boston, Mass.—11 stories and roof, steel frame, rectangular plan. Concrete work, started December 15th, was finished before February 1st—better than 1½ floors a week.

Typical 'Incor' Savings

After placing, concrete was heated 2 days—saving one day per floor. Daily cost for fuel and fire-tending labor, $67.63. On 24 pours, that meant a total saving of $1623 in heat-protection costs.

Three form sets were used. Without 'Incor', 4 sets would have been needed. 'Incor' saved one form set, cost $2500.

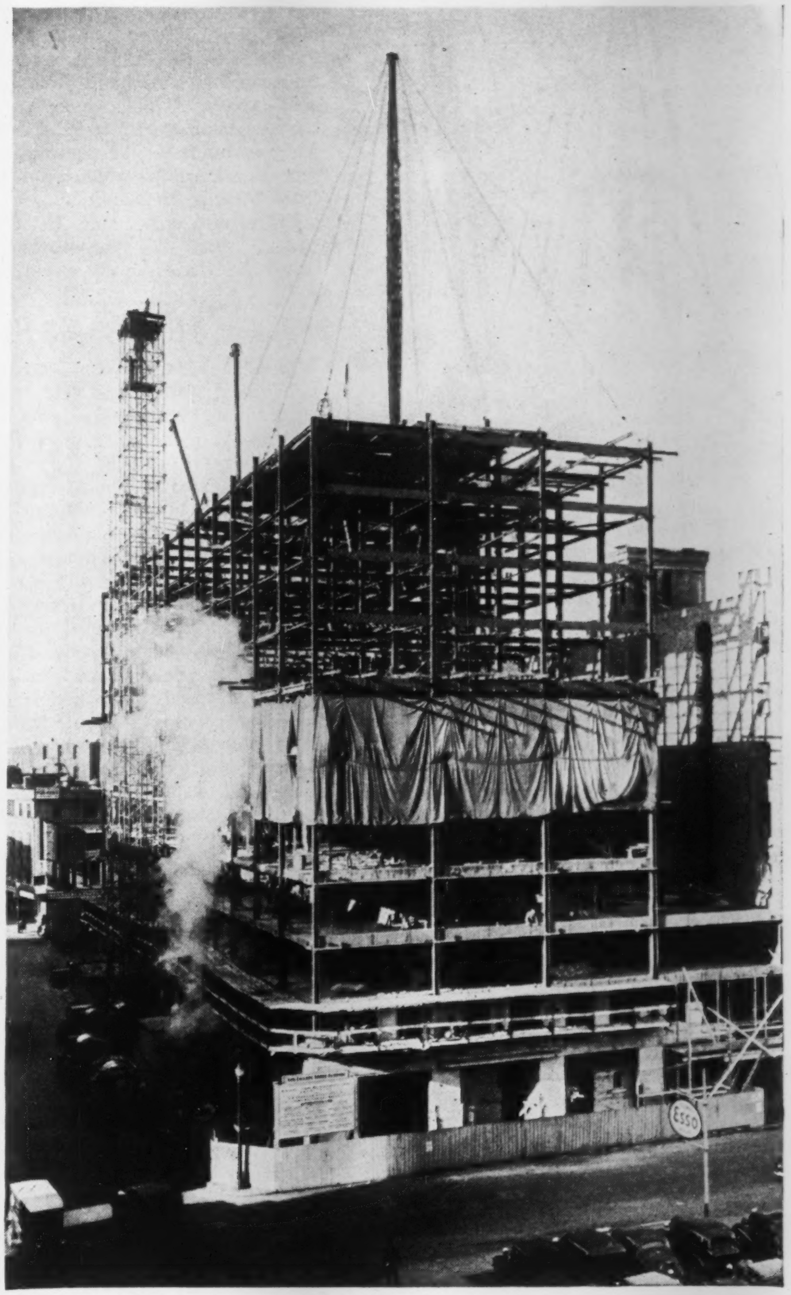
And the job was finished 15 days sooner. Daily job overhead was $162 a day; so 15 days saved meant $2430.

Saved: $1.22 a Cu. Yd.

Total 'Incor' saving, $6553. Less extra cost of 'Incor', $1900. Net saving, $4653—OR $1.22 A CU. YD. OF CONCRETE.

Figure these savings on work now in planning stage. Then use 'Incor'* if it shows you a profit—otherwise, use Lone Star. You gain either way, because better cement makes better concrete. Send for copy of "Cutting Concrete Costs." Lone Star Cement Corporation, Room 2263 342 Madison Avenue, New York.

*Reg. U. S. Pat. Off



LONE STAR CEMENT CORPORATION

MAKERS OF LONE STAR CEMENT...'INCOR' 24-HOUR CEMENT

Shaft Core Drill

THE CALYX SHAFT CORE DRILL, pictured below, is fully described, with illustrations of shafts and cores, in bulletin No. 2213 recently published by Ingersoll-Rand Company.

With this drill, shafts usually 36 in. but as large as 6 ft in diameter and to depths of 100 ft, may be drilled in dam foundation sites and other locations where it is desirable to have accurate information regarding the formations. A cutting speed of 8 to 10 in. per hour in granite is reported, with greater speeds in softer materials. After the cores are removed for surface study, geologists and engineers may be lowered into the shafts for visual inspection of the sub-surface formations. The manufacturer states that the value of this drill for sub-surface exploratory work has been demonstrated on many large dams.

Copies of the bulletin will be forwarded from the manufacturer's main office at 11 Broadway, New York, N.Y.

Neoprene

NEOPRENE, an engineering material with rubber-like properties, yet one which resists the deteriorating effects of oil, heat, sunlight, chemicals and oxidation, is described in detail in a new handbook published by Rubber Chemicals Division, E. I. du Pont de Nemours & Company. This presentation considers separately the effects of the various forces which result in rapid deterioration of rubber products and indicates the type of service which may be expected with neoprene. Specific applications of neoprene, including hose, electrical cable, molded parts, extruded material, sheet goods, and gaskets are described. The booklet may be obtained from the Publicity Department at Wilmington, Del.

Electrode for Flat Welding of Deep-Groove Joints

A NEW arc welding electrode, which has been developed especially for flat welding of deep-groove joints in mild steel and which provides welds of new high quality in this type of work, is announced by The Lincoln Electric Company, Cleveland, Ohio.

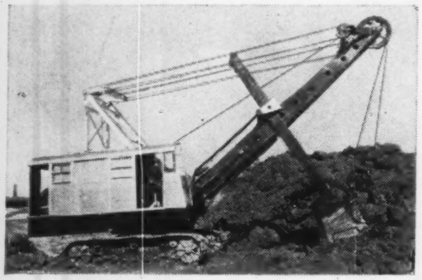
The new electrode, "Fleetweld 9," is designed for use in the manufacture of products such as tanks, pressure vessels, etc., utilizing heavy plate construction and requiring production of highest quality butt welds at maximum economy. The electrode provides weld deposits possessing high physical properties. Proper procedure with the electrode overcomes certain conditions frequently encountered in deep-groove welding which tend to cause the formation of surface holes in the metal. At the same time, the electrode has operating characteristics which assure uniformly economical performance.

"Fleetweld 9," made in three sizes, $^3/_{16}$, $^1/_4$, and $^5/_{16}$ in., will operate with either alternating or direct current.

Large High Speed Shovel

THE HARNISCHFEGER CORPORATION of Milwaukee announces the new P&H Model 955 Shovel—a high-speed, fully convertible machine with a capacity of $2^1/_2$ cu yds.

Tons of dead weight removed from the 955—in the upper revolving deck, the lower car body, crawler side cranes and the digging attachment—enables it to swing faster and stop faster, with less wear and tear on the machinery. Heavy-duty roller bearings have been used on the swing clutches, hoist drum, crown drum, and all parts that receive hard punishment in operation. Additional modernized points in design include: double safety boom hoist, split second clutches, 6 lubricated hook rollers, live-roller circle for a faster swing, all welded shovel boom, and a lighter aluminum boom for dragline work.



POWERED by an 8-cylinder 185 hp Fairbanks-Morse Diesel engine, the 955 is economically operated and quickly responds to controls. Special tandem drum arrangement insures parallel cable pull to and over the center line of the machine to eliminate excessive cable wear. Split sprocket lagging is provided for quick changeover for shovel service.

A new bulletin on the 955 giving further information may be obtained from the Harnischfeger Corporation, 4400 W. National Avenue, Milwaukee, Wis.

Folders Announced

ASPHALT—Specifications and Designs for the many uses of Kentucky Rock Asphalt in construction and maintenance are given in a well written 28-page booklet. Kentucky Rock Asphalt Institute, 312 S. Fourth St., Louisville, Ky.

DREDGER—The flexibility of the Ruth Dredger in meeting the requirements for all types of ditch digging and maintenance is described and illustrated in a 4-page folder. Ruth Dredger Mfg. Corp., 5980 S. Boyle Ave., Los Angeles, Cal.

EARTH MOVING EQUIPMENT—A 20-page profusely illustrated booklet shows the Le Tourneau equipment in operation on various types of work. R. G. Le Tourneau, Inc., Peoria, Ill.

HOSE—Electric Hose & Rubber Co., Wilmington, Del., have just produced a new 64-page loose-leaf and pocket size catalog of their complete line of braided and molded hose. The data and helpful information are indexed according to "purpose" as well as kind of hose.

"K" MONEL—The engineering properties of this metal are completely covered in a 16-page, $8^1/_2$ in. × 11 in. booklet. It tabulated data cover: composition of the metal; physical constants; all properties; hot and cold mill working; heat treatment; shop machining, welding, soldering, grinding, polishing, buffing and pickling; castings; corrosion resistance; and applications. The International Nickel Company, 67 Wall Street, New York, N.Y.

LATHE MANUAL—Pictures clearly how to operate the modern lathe and includes easy-to-understand technical data for machining new metals, alloys, plastics, etc. 272 pages—metal binding. $1.00 delivered. Atlas Press Company, 1819 North Pitcher Street, Kalamazoo, Mich.

PUNCH BAR—The Ashley Core Punch Bar is a combination of hole making and dynamite-loading tool for use in blasting ditches in wet ground. Its construction and use are described in an article in the July Agricultural News Letter of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

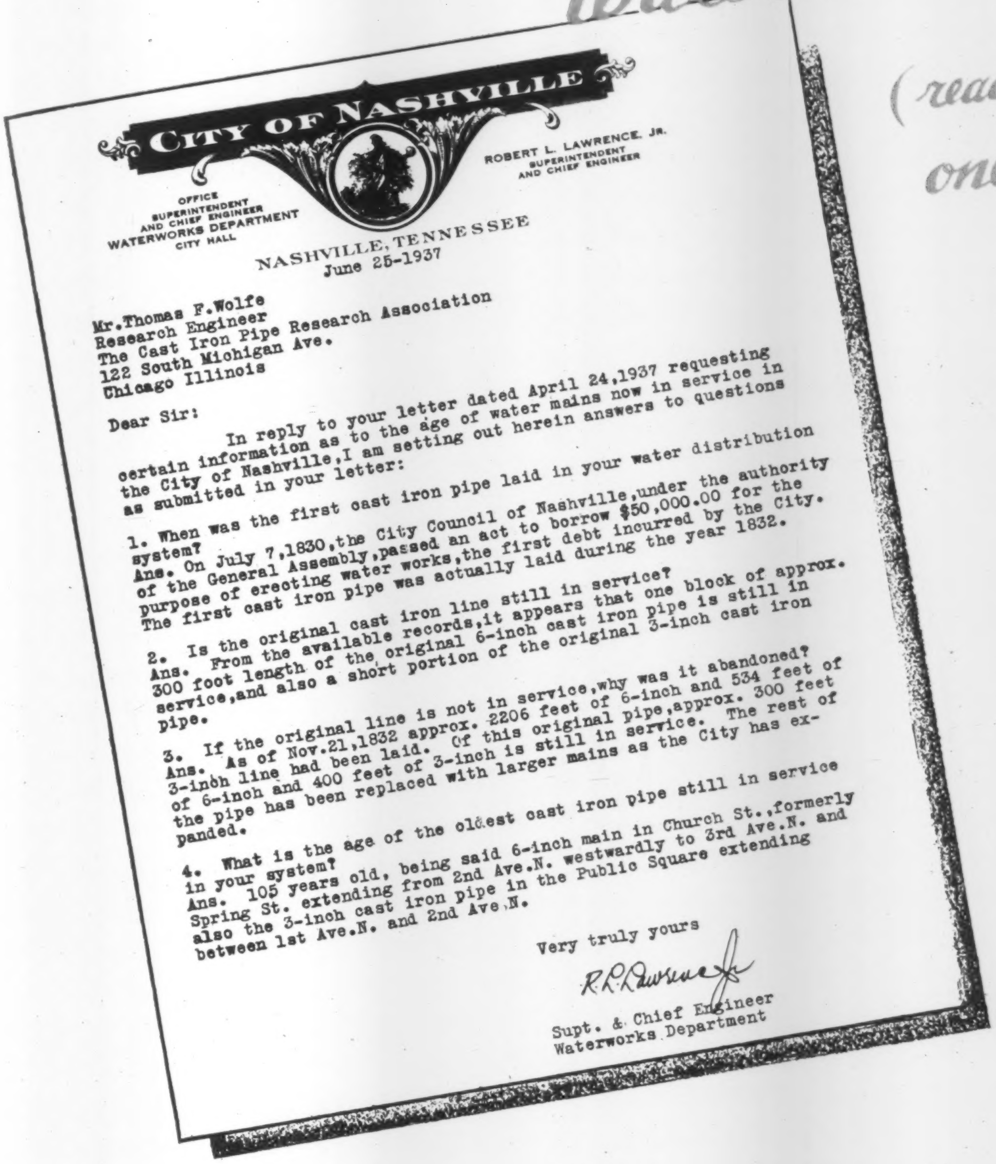
PYROMETERS—Round Chart Potentiometer Pyrometers available as temperature recorders and controllers—both pneumatic and electrically operating types—are described in a new 12-page bulletin. The Bristol Company, Waterbury, Conn.

WELDED DESIGN CHART—The engineering drafting room chart brought out last fall by The Lincoln Electric Company, Cleveland, O., has been revised to include the latest weld symbols adopted by The American Welding Society in May. The arc welded design chart is 24 in. wide by $35^1/_2$ in. high, with metal strips across the top and bottom, and a clip at the top for attachment to the wall.

WELDED PIPING DESIGN—Complete handbook information on design and layout of piping for welded connections is contained in "Design of Welded Piping," a 200-page (6 × 9) booklet containing over 100 figures and tables, published by The Linde Air Products Company, N.Y.

A letter of interest to water works men

(reading time one minute)



CITY OF NASHVILLE

OFFICE
SUPERINTENDENT
AND CHIEF ENGINEER
WATERWORKS DEPARTMENT
CITY HALL

ROBERT L. LAWRENCE, JR.
SUPERINTENDENT
AND CHIEF ENGINEER

NASHVILLE, TENNESSEE
June 25-1937

Mr.Thomas F.Wolfe
Research Engineer
The Cast Iron Pipe Research Association
122 South Michigan Ave.
Chicago Illinois

Dear Sir:

In reply to your letter dated April 24,1937 requesting certain information as to the age of water mains now in service in the City of Nashville,I am setting out herein answers to questions as submitted in your letter:

1. When was the first cast iron pipe laid in your water distribution system?
Ans. On July 7,1830,the City Council of Nashville,under the authority of the General Assembly,passed an act to borrow $50,000.00 for the purpose of erecting water works,the first debt incurred by the City. The first cast iron pipe was actually laid during the year 1832.

2. Is the original cast iron line still in service?
Ans. From the available records,it appears that one block of approx. 300 foot length of the original 6-inch cast iron pipe is still in service,and also a short portion of the original 3-inch cast iron pipe.

3. If the original line is not in service,why was it abandoned?
Ans. As of Nov.21,1832 approx. 2206 feet of 6-inch and 534 feet of 3-inch line had been laid. Of this original pipe,approx. 300 feet of 6-inch and 400 feet of 3-inch is still in service. The rest of the pipe has been replaced with larger mains as the City has expanded.

4. What is the age of the oldest cast iron pipe still in service in your system?
Ans. 105 years old, being said 6-inch main in Church St.,formerly Spring St. extending from 2nd Ave.N. westwardly to 3rd Ave.N. and also the 3-inch cast iron pipe in the Public Square extending between 1st Ave.N. and 2nd Ave.N.

Very truly yours

R.L.Lawrence Jr

Supt. & Chief Engineer
Waterworks Department

We have asked Nashville and 211 other cities whether *original cast iron mains* in their water distribution systems were still in service. Mr. Lawrence's letter (reproduced by permission) is typical of 203 others out of 212—96 percent—whose answers were—*yes*. Only a material with great *bursting* strength, *beam* strength, *crushing* strength, *impact* strength, and *effective corrosion resistance*—indispensable requirements of an underground water main—can render such enduring and economical service.

THE CAST IRON PIPE RESEARCH ASSOCIATION

Thomas F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois

CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

Concrete Arch, France. La reconstruction du pont du carrousel sur la Seine a Paris, P Lévy. *Technique Moderne*, vol. 29, no. 11, June 1, 1937, pp. 369–377. Execution of work; illustrations of construction in progress and auxiliary equipment used.

Flood Damage. Bridge Building Down East, W. G. Bowman. *Eng. News-Rec.*, vol. 119, no. 4, July 22, 1937, pp. 149–153. Review of flood damage to New England highway bridges; repair and construction methods.

Floors. Strength of Concrete-Steel Bridge Floor Slabs, G. P. Boomsliter. *West Va. Univ.—Eng. Experiment Station—Research Bul.*, no. 16, series 37, no. 7-IV, Jan. 1937, 28 pp. Results of tests of concrete-steel bridge floor slabs 13 ft long, 16 in. wide, up to 7 in. in depth; validity of theory of concrete steel slabs; economy of steel-grid floor slabs; test of open-grid floor slab.

New England. Bridge Engineer's Odyssey, W. G. Bowman. *Eng. News-Rec.*, vol. 119, no. 3, July 15, 1937, pp. 104–109. Review of new construction and repairing of bridges in New England states resulting from flood of March 1936.

Railroad, Brazil. A nova ponte de Larangeiras Na estrada de ferro Da. Theresa Christina em Santa Catharina, E. Moraes Vieira. *Revista do Club de Engenharia*, vol. 3, no. 30, Mar. 1937, pp. 1275–1281. New Larangeiras Bridge on Dona Theresa Christina railroad in Santa Catharina; general historical outline; studies for project; final data; 300-m, Gerver-type, straight-beam bridge on reinforced concrete pillars; 1,300-m approach on earth fill across marsh; constructional details.

Railroad, Construction. Draw-Span Protection Embodies Novel Features of Design. *Ry. Age*, vol. 103, no. 4, July 24, 1937, pp. 96–98. Structure is result of attempt to develop plan providing maximum lateral stiffness with no greater number of piles than has been used in conventional designs for structure of same size; built to protect lower bridge of Toledo Terminal across Maumee River; all timbers pre-framed before treatment; illustrations given.

Reconstruction. Bridge Building Follows Flood, W. G. Bowman. *Eng. News-Rec.*, vol. 119, no. 2, July 8, 1937, pp. 52–58. Review of damage to bridges in New England caused by flood of March 1936; repair methods and reconstruction practice adopted.

Steel. Idées actuelles concernant l'esthétique des ponts metalliques, Martinet and Icre. *Annales de l'Institut Technique*, vol. 2, no. 1, Jan.–Feb. 1937, pp. 1–14. Discussion of architectural treatment of various types of steel bridges, including arch and suspension bridges.

Steel Arch, Baltimore, Md. Twin Tied Arches for Baltimore Bridge, O. H. Schroedl. *Eng. News-Rec.*, vol. 119, no. 7, Aug. 12, 1937, pp. 257–261. Replacement of two 55-year-old, pin-connected truss spans over Pennsylvania Railroad on Guilford Avenue, Baltimore, with modern steel tied-arch structure, also of two spans and on old foundations; choice of type; arch design; rigid top laterals; steel roadway deck; unusual guard fence; hazardous construction; total cost $185,747.

Suspension. Reflexions nouvelles sur les ponts suspendus, G. Pigeaud. *Génie Civil*, vol. 111, nos. 2864, 2865, 2866, and 2867, July 3, 1937, pp. 8–12; July 10, pp. 34–36; July 17, pp. 56–59; and July 24, pp. 77–81. July 3: Theoretical mathematical discussion of suspension bridges without stiffening girders. July 10: Analysis of stresses in suspension bridge traversed by train. July 17: Analysis of suspension bridges with stiffening girders. July 24: Stresses due to overloading; design of horizontal wind bracing.

BUILDINGS

Auditoriums, Acoustics. Method of Acoustical Design of Rooms Equipped with Loud Speakers, V. Furdujev. *Academie des Sciences de l'URSS—C R.*, vol. 15, nos. 6–7, 1937, pp. 313–314. Report from Research Institute of Motion Pictures and Photography of USSR, presenting theoretical mathematical analysis of acoustic design of modern auditoriums. (In English.)

Construction. Columns Upended and Set by Special Sling, G. W. Maker. *Eng. News-Rec.* vol. 119, no. 2, July 8, 1937, p. 75. Description of special harness devised in construction of building for Christian Science Publishing Society, Boston, for setting columns 40 in. in diameter, 22 ft high, weighing about 15 tons.

Monuments, France. La porte monumentale de la Place de la Concorde, H. Marcus. *Technique Moderne*, vol. 29, no. 12, June 15, 1937, pp. 409–411. Series of constructional details of monumental gate at Place de la Concorde as noted at International Exposition of Paris in 1937.

Railroad, Maintenance and Repair. Catching up on Building Maintenance. *Ry. Eng. & Maintenance*, vol. 33, no. 8, Aug. 1937, pp. 540–542. Program of building repair and painting has been inaugurated by receivers of Wabash; purpose is to improve condition of as many buildings as possible before end of present working season; article describes manner in which program is being carried out, organization of forces, improved method for removing old paint, use of spray painting, and how work is being done with only normal seasonal increase in building force.

Welded Steel Structures, Specifications. Erfahrungen mit den deutschen Vorschriften fuer geschweisste Stahlbauten, G. Bierett. *Sparwirtschaft*, vol. 14, nos. 11 and 12, Nov. 1936, pp. 293–297, and Dec., pp. 325–330. Experiences with German specifications for welded steel structures, with special reference to structural steel St. 37; results of investigations of columns, beams, etc., for building and bridge construction.

CITY AND REGIONAL PLANNING

Memphis, Tenn. City Planning in Memphis, L. P. Cockrill. *Eng. News-Rec.*, vol. 119, no. 6, Aug. 5, 1937, pp. 230–234. Benefits of planning; major street plan; transit system studies; improving transit facilities; transportation problems; recreational facilities; zoning.

Oregon. Planned Community to Be Built on Site of Destroyed Town. *Eng. News-Rec.*, vol. 119, no. 5, July 29, 1937, pp. 187–188. Planned reconstruction of town of Bandon-by-the-Sea, Ore.; small industrial community with population of 1,500, which burned to ground in forest fire of 1936.

Transport. Towns: Town Planning and Town Transport, F. Pick. *Passenger Transport J.*, vol. 76, no. 1929, June 25, 1937, pp. 351–355. Object of article is to show how transport and planning must run together; broad indication of operating and commercial factors which govern successful realization of both transport and planning. Before Mun. Tramways & Transport Assn.

CONCRETE

Aggregates. Die Verwendungsmoeglichkeiten besonders grober Zuschlaege, W. R. Gruen. *Bauingenieur*, vol. 18, nos. 9/10, Mar. 3, 1937, pp. 112–113. Results of tests on concrete samples made with very coarse aggregate, up to 60 mm in size; fields of application for such concrete.

Building Materials, Brick. Die fugenlose Ziegeltonwand, H. Schwarzkopff. *Deutsche Bauzeitung*, vol. 71, no. 23, June 9, 1937, pp. B417–B418. Proposed use of crushed brick as concrete aggregate for cheap housing construction.

Curing. Raumaenderungen von Portlandzementbeton bei Wechselerhaertung, A. Frank. *Zement*, vol. 26, nos. 9 and 10, Mar. 4, 1937, pp. 137–141, and Mar. 11, pp. 153–155. Volume changes in portland-cement concrete with alternate water- and air-curing; loss of strength produced by alternate curing is traced to alternate expansion in water and shrinkage in air setting up internal stresses in mass; elastic properties of concrete are greatly improved by curing in water.

Construction, Subaqueous. Study of Sub-Aqueous Concrete, A. R. Anderson. *Am. Concrete Inst.—J.*, vol. 8, nos. 3 and 5, Jan.–Feb. 1937, pp. 339–346, (discussion) May-June, pp. 346-1–346-3. Comparative observations on behavior of concrete deposited under water by tremie and by drop-bottom bucket; relative strengths of tremie concrete and control concrete; effect of grading of aggregates and fineness of cement on compressive strength; most advantageous mixture for subaqueous concrete.

Testing. Cement and Concrete Studies on Passamaquoddy Tidal Power Project, H. J. Casey. *Am. Concrete Inst.—J.*, vol. 8, no. 3, Jan.–Feb. 1937, pp. 279–302. Report on extensive cement and concrete tests referring to use of salt water for mixing, heat of hydration, effect of magnesium sulfate, bleeding, optimum mix, volumetric change, curing, salt-water curing; curing procedure for mass and semi-mass concrete; types of cement proposed.

CONSTRUCTION INDUSTRY

Chemical Research. Chemische Untersuchung von Baustoffen, H. Wagner. *Chemiker-Ztg.*, vol. 61, no. 25, Mar. 27, 1937, pp. 265–267. Chemical investigation of building materials, brief description given of technique of chemical laboratory in investigations such as analysis of hardened mortar and concrete, determination of composition of concrete admixtures of various types, of humus and clay contents of sands, of soluble salt content of bricks and tiles, etc.

Costs. Contract Unit Prices. *Eng. News-Rec.*, vol. 119, no. 7, Aug. 12, 1937, p. 286, and (adv. sec.) p. 32. Unit costs bid on construction of Roosevelt Dam canal; levee construction, California; New Mexico highways; harbor dredging, Connecticut; resurfacing Nepaug Dam, Connecticut; and highway surfacing, California.

Costs, Highway. Contract Unit Prices. *Eng. News-Rec.*, vol. 119, no. 3, July 15, 1937, p. 120, and (adv. sec.) p. 28. Unit costs bid on construction of highway in Georgia; grade-crossing, Maine; bunker and wharf, California; highway surfacing, Washington; highway underpass, Stockton, Calif.

DAMS

Boulder Dam Project, Earthquakes. Boulder Dam Earthquakes Continue. *Eng. News-Rec.*, vol. 119, no. 5, July 29, 1937, p. 178. Statistics of 49 earthquake shocks recorded at Boulder Dam since September 1936.

Concrete Gravity, Construction. Die Betonarbeiten der Tschubuktalsperre, Kunze. *Bauingenieur*, vol. 18, nos. 7–8, Feb. 19, 1937, pp. 80–85. Concrete making and distribution in construction of Chubuk concrete gravity dam near Ankara, capital of Turkey, having volume of 100,000 cu m; observations on formation of cracks.

CORROSION-RESISTING NI-RESIST WINS BERTH IN MONONGAHELA LOCKS

● *View of Monongahela River Lock No. 2 looking upstream*

The Monongahela River, main traffic artery through the busy Pittsburgh industrial area, is studded with locks to facilitate the several million tons of shipping that move up and down stream every month.

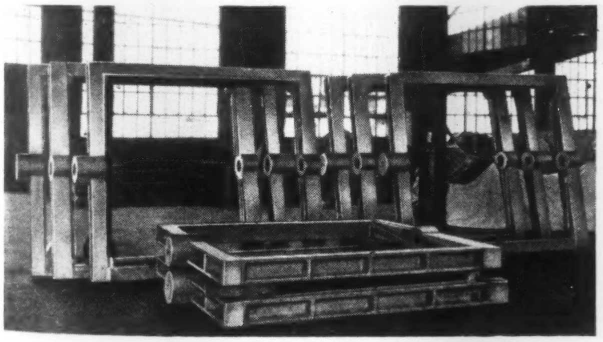
Drainage from mines, mills, etc. that line its banks present a serious maintenance problem to Army Engineers. Drainage from these contaminates the water, making it highly corrosive. As a result, metallic parts of lock equipment deteriorate rapidly.

Plain and low alloy cast irons which have been used for butterfly valve frames do well but not well enough. Replacements are usually made after very short service.

● *A batch of Ni-Resist valve frame castings made by Youngstown Foundry and Machine Co., Youngstown, Ohio.*

Recently U. S. Engineers decided to test other materials, found that much better corrosion resistance was offered by Ni-Resist,* a special Nickel Cast Iron composition containing approximately 14% Nickel, 6% copper and 2% chromium.

Twelve Ni-Resist butterfly valve frames, consisting of twelve tops, twelve bottoms and twenty-four side castings weighing a total of 40,000 pounds, were ordered and have been installed. These castings were produced by Youngstown Foundry and Machine Co., Youngstown, Ohio. This is just one of many applications where Ni-Resist has proven definitely superior in combating corrosion. It is equally effective in equipment designed to handle corrosive vapors and gases.



○ *Ni-Resist frames assembled and ready for installation*

We invite consultation on the use of this special Nickel Cast Iron and other alloys of Nickel in your equipment.

NICKEL
CAST IRON

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N.Y.

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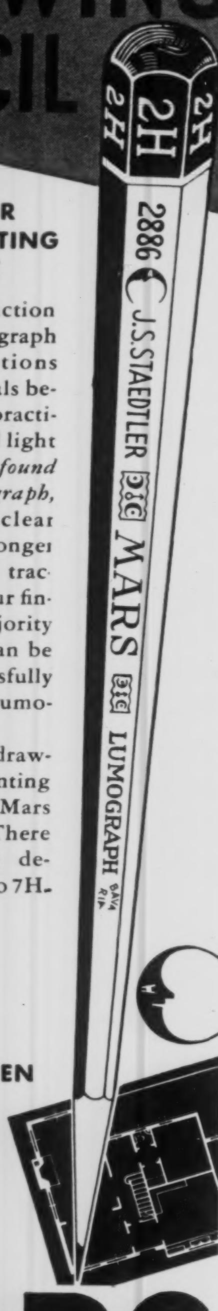
* Ni-Resist--Reg. U. S. Pat. Off. by the International Nickel Co.--Canadian Patent No. 278,180

NEW!! A DRAWING PENCIL



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With the introduction of the Mars Lumograph Pencil, reproductions from pencil originals became universally practical. A new, patented light resisting element, *found only in Mars Lumograph,* produces sharp, clear blueprints. It is no longer necessary to make tracings, or "ink in" your finished work. The majority of your drawings can be blueprinted successfully from your Mars Lumograph originals.

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CONCRETE GRAVITY, OREGON. Portland-Puzzolan Cement as Used in Bonneville Spillway Dam, R. R. Clark and H. E. Brown, Jr. *Am. Concrete Inst.—J.*, vol. 8, nos. 3 and 5, Jan.-Feb. 1937, pp. 183–221, and (discussion) May–June, pp. 222-1–222-7. General description; location and foundation conditions; design of dam; cement investigation and selection; special cement specifications; final concrete studies; embedded instruments for temperature and strainmeter records; stress analysis; construction experience and condition of finished concrete.

CONCRETE GRAVITY, WASHINGTON. New Record in Pouring Concrete. *Eng. News-Rec.*, vol. 119, no. 3, July 15, 1937, pp. 101–103. Recent progress at Grand Coulee Dam; completion of preliminary work and preparation for concrete placing schedule of 440,000 cu yd per month; changes in handling materials.

FLOOD CONTROL

CALIFORNIA. Structures to Control Torrents, R. E. Cruse. *Eng. News-Rec.*, vol. 119, no. 2, July 8, 1937, pp. 67–72. Description of debris basins, detention dams, open and covered channels, channel crossings, and other flood-control structures in Los Angeles County; organizing for construction; main construction items.

NEW ENGLAND. New England Flood Plans Analyzed. *Eng. News-Rec.*, vol. 119, no. 4, July 22, 1937, pp. 144–146. Article advocating thorough study to determine maximum possible use of reservoirs proposed for Connecticut and Merrimack River valleys; comparison of plans.

RESERVOIRS. Flood Control by Reservoirs, A. E. Morgan. *Eng. News-Rec.*, vol. 119, no. 7, Aug. 12, 1937, pp. 263–268. Discussion of measures of flood protection for lower Mississippi River recommending reservoirs in lower Tennessee and Ohio valleys as step in ultimate flood protection; project of dam on Tennessee River at Gilbertsville and dam across Ohio and Cumberland rivers at Dog Island with short, interconnecting, navigation, and equalizing canal between Tennessee and Cumberland rivers; benefits of project; protection for cities.

FOUNDATIONS

RETAINING WALLS, DESIGN. Retaining Wall Design, E. A. Menuez. *Eng. News-Rec.*, vol. 119, no. 7, Aug. 12, 1937, pp. 272–273. Derivation of formulas from which base width of gravity retaining walls may be obtained by substitution; horizontal earth thrust; inclined earth thrust.

SOIL MECHANICS, BIBLIOGRAPHY. Schrifttum ueber Bodenmechanik, H. Petermann and E. Boedeker. *Forschungsgesellschaft fuer das Strassenwesen E. V.*, no. 12, May 1937, 196 pp. International bibliography in various branches of soil mechanics, including 2,464 items covering period from 1925 to middle of 1936; statics and dynamics of soils; ground water; applications of soil mechanics to construction of water works, tunnels, roads, railroad tracks, and to mining operations; subject and author indexes included.

HYDRAULIC ENGINEERING

FLOW OF WATER, OPEN CHANNEL. Investigations of Wave-Motion in Long Pools, etc.; I. B. Egiazarov. *Izvestiya Nauchno-Issledovatelskovo Instituta Hydrotechniki*, no. 19, 1936, pp. 105–138. Review of reports presented at 16th International Navigation Congress and of work carried out at Leningrad Hydroelectric Laboratory. (In Russian, with English abstract, pp. 135–138.)

FLOW OF WATER, PERCOLATION. Principles of Hydromechanical Method of Solution of Problem of Free Percolation from Open Channels, N. N. Pavlovsky. *Izvestiya Nauchno-Issledovatelskovo Instituta Hydrotechniki*, no. 19, 1936, pp. 5–24. Principles of method based upon Joukovsky's complex function and conformal representation; case of free percolation from open channels into infinite half space. (In Russian, with brief English abstract, p. 24.)

FLOW OF WATER, TURBULENT. Upon Distribution of Velocities in Turbulent Flow of Liquids, N. N. Pavlovsky. *Izvestiya Nauchno-Issledovatelskovo Instituta Hydrotechniki*, no. 19, 1936, pp. 177–207. Method developed by writer for plotting graphs of local averaged velocities for various lines lying in cross-sectional plane of any polygonal shape, assuming that roughness of pipe walls is uniform. (In Russian, with brief English abstract, p. 207.)

HYDROLOGY AND METEOROLOGY

RAIN GAGES, RECORDING. Einheitliche Richtlinien zur Auswertung von Schreibregenmosseraufzeichnungen, F. Reinhold. *Gesundheits-Ingenieur*, vol. 60, nos. 2, 3, and 4, Jan. 9, 1937, pp. 22–26; Jan. 16, pp. 40–45; and Jan. 23, pp. 55–61. Proposed standard method for reduction of automatic rain-gage records; evaluation of cloudburst records with reference to intensity, duration, and frequency; alignment charts and graphs; analytic and graphical methods of frequency determination.

IRRIGATION

CANALS, CONCRETE LINING. Concrete Rehabilitation Work on Uncompahgre Project, A. B. Reeves. *Am. Concrete Inst.—J.*, vol. 8, no. 3, January–February 1937, pp. 303–310. Condition of 4-mile concrete-lined section of South Canal of Uncompahgre Project after 30 years of operation; effect of swelling shale on sidewalls and floor; repairing of lining with gunite; design and construction of new canal lining.

LAND RECLAMATION AND DRAINAGE

GERMANY. Landeskultur-Aufgaben an der Schleswig-Holsteinischen Westkueste, J. M. Lorenzen. *VDI Zeit*, vol. 81, no. 26, June 26, 1937, pp. 731–738. Agricultural problems on west coast of Schleswig-Holstein; scientific research of marshy island in North Sea; biological research; practical results from biological and soil research; results of culture of soil begun in 1934; present status.

MATERIALS TESTING

CEMENT. Essais nouveaux sur les ciments destines aux travaux de la mer, P. Dumesnil. *Revue des Materiaux de Construction et de Travaux Publics*, no. 328, Jan. 1937, pp. 1–3. New tests on cements for marine works; it is claimed that laboratory tests can never replace practical marine tests.

NEW PAPERS. A.S.T.M. Convention at New York. *Eng. News-Rec.*, vol. 119, no. 3, June 15, 1937, pp. 110–114. Proceedings of 1937 annual meeting of American Society for Testing Materials, including abstracts of papers and discussions on steel and wrought iron, impact testing, corrosion of metals, fatigue of metals, cast iron, paints, bituminous materials, cement and concrete, masonry materials, brick efflorescence, timber, consistency problem, and methods of testing.

PORTS AND MARITIME STRUCTURES

ASPHALTIC CONCRETE. Design of Asphalt Mixtures for Underwater Construction, R. M. McCrone and F. C. Field. *Am. Soc. Testing Matls.—Preprint*, no. 84, mtg. June 28–July 2, 1937, 8 pp. Progress in developing mixtures for mass construction above and below water line with special reference to jetty work in United States.

BREAKWATERS. Wellenwirkung an Hafendaemmen, G. de Thierry. *VDI Zeit*, vol. 81, no. 26, June 26, 1937, pp. 743–744. Review of recent experimental studies of effect of wave action on vertical face breakwaters and piers constructed in Italy, Algeria, and Switzerland; limits of applicability of formulas derived analytically and by testing of models.

BREAKWATERS, WAVE EFFECT. Action des vagues sur les digues à paroi verticale, A. Stuky and D. Bonnard. *Travaux*, vol. 21, no. 49, Jan. 1937, pp. 13–18. Report on tests of models made at Hydraulic Laboratory of University of Lausanne, Switzerland, on action of waves on vertical-face breakwaters and piers.

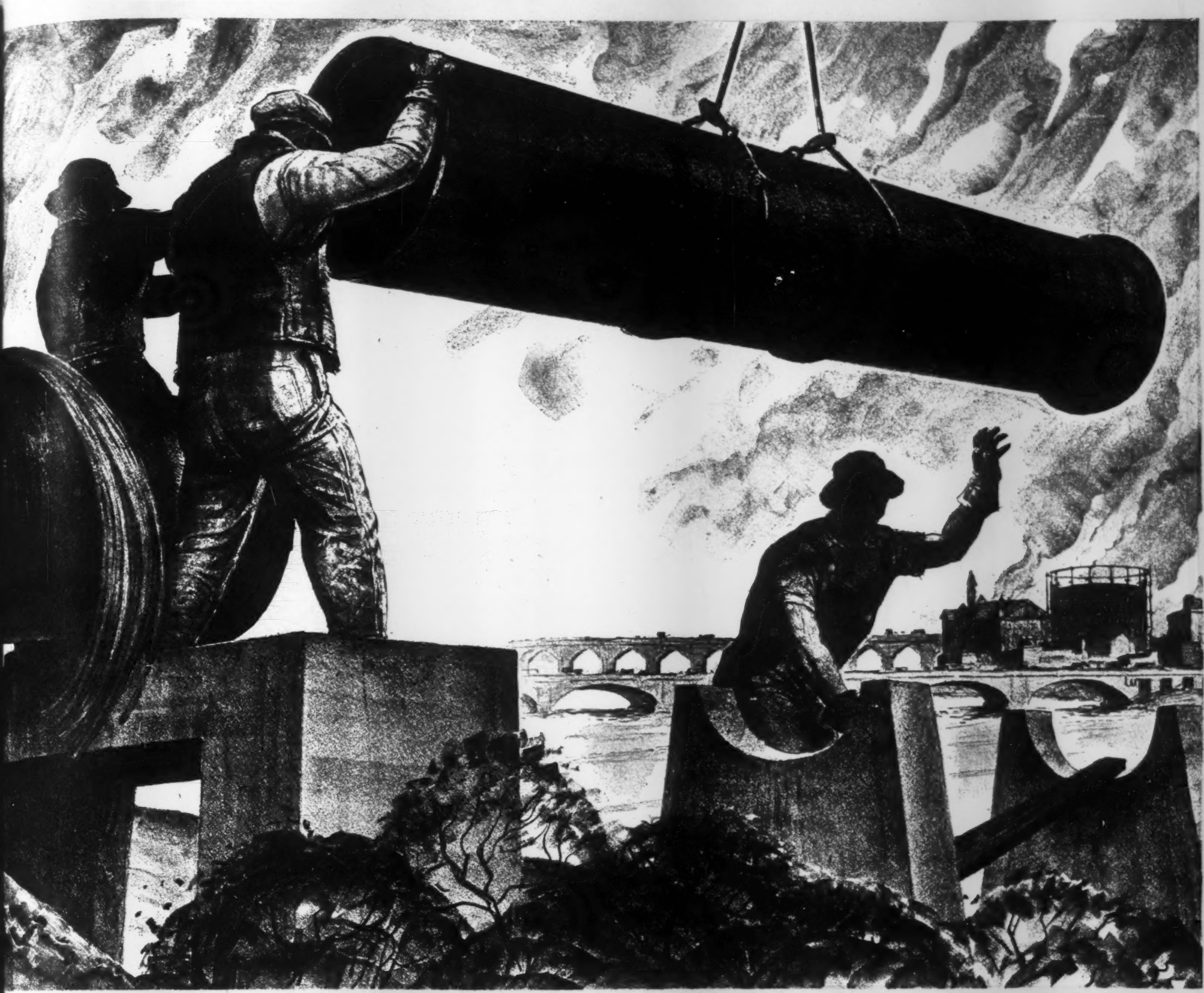
BRUSSELS. Seekanal und Seehafen von Bruessel, Bolle. *Werft-Reederei Hafen*, vol. 18, no. 4, Feb. 15, 1937, pp. 54–55. Canal and seaport of Brussels; description of work begun in 1900 for widening of Willebroeck Canal between Antwerp and Brussels, and construction of harbor in Brussels at canal terminal; maps presented.

EQUIPMENT. Die Hafenumschlagstechnik der letzten 30 Jahre, O. Wundram. *Foerdertechnik*, vol. 30, nos. 10 and 11, May 12, 1937, pp. 201–206, and May 26, pp. 226–235. Trans-shipping technique of last 30 years; discussion of various equipment and description of progress based on illustrations mainly in port of Hamburg.

JETTIES, FAILURE. Asphalt-Bound Jetty Head Fails. *Eng. News-Rec.*, vol. 119, no. 7, Aug. 12, 1937, pp. 273–275. Failure of south jetty at mouth of Columbia River, due to insufficient bond in asphalt used as binder for holding together large rock; asphalt placement methods; effect of winter storms.

MONTREAL. Reconditioning Wharves and Flumes in Montreal Harbor, J. P. Leclaire. *Can. Engr.*, vol. 72, no. 11, Mar. 16, 1937, pp. 7–11. Reconstruction of Windmill Point Wharf, King Edward Pier, and Alexandra Pier, necessitated by dredging of harbor to accommodate large ocean vessels.

OIL STORAGE. Stanlow: Great Oil Port, J. H. Lockett. *Petroleum Times*, vol. 37, no. 96, June 12, 1937, pp. 783–786. Description of docks and oil storage installations and petroleum refineries adjacent to Manchester Ship Canal; procedure in handling oil tankers.



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ROADS AND STREETS

Highway Administration, Financing. It's Motorist Who Pays Bill, R. E. Elgen. *Automotive Industries*, vol. 77, no. 2, July 10, 1937, pp. 50–52, and 69–70. According to Census Bureau, those who owned automobiles, trucks, and motor buses paid $1,017,824,700 in various kinds of taxes in 1935; state highway expenditures compiled for calendar year 1935.

Highway Lighting. What About Highway Lighting? S. G. Hibben. *Eng. News-Rec.*, vol. 119, no. 6, Aug. 5, 1937, pp. 217–220. Progress made in highway lighting, its possibilities and cost; rôle of highway lighting in reducing traffic accidents and in increasing highway transport capacity; statistical data; types of highway lighting equipment.

Highway Systems, Germany. Impressions of German Express Roads, P. Wooton. *Eng. News-Rec.*, vol. 119, no. 4, July 22, 1937, pp. 147–148. Tourist's observations on new German system of superhighways.

Highway Systems, Minnesota. Highway Design and Development in Twin Cities Area, O. L. Kipp. *Minn. Federation Arch. & Eng. Soc.—Bul.*, vol. 22, no. 5, May 1937, pp. 5–8. Description of new rectangular highway belt around Minneapolis and St. Paul enclosing area of about 250 sq miles.

Joints. New Expansion Joint Proves Good, E. J. Webb. *Eng. News-Rec.*, vol. 119, no. 2, July 8, 1937, pp. 72–73. Description of Cayuga Lake Boulevard, in New York State; expansion joints featuring bent double dowels and form plates that hold them in premolded filler.

Limerock. Limerock Roadbuilding Methods, T. B. Massie. *Eng. News-Rec.*, vol. 119, no. 5, July 29, 1937, pp. 193–194. Review of Florida practice in construction of low-cost limerock roads; design elements; laying limerock base.

Maintenance and Repair. New Technique in Road Honing, L. F. Johnson. *Eng. News-Rec.* vol. 119, no. 7, Aug. 12, 1937, pp. 277–279. Improved results in New Hampshire tarred-gravel road maintenance secured by special hones and honing methods; hone or maintainer hung under truck for preparing tarred-gravel roads for tar retreatment; types of road hones used in regular maintenance of tarred-gravel roads in New Hampshire; costs.

Materials, Cement. Untersuchungen ueber den Einfluss von 9 Zementen auf das Schwinden, etc., F. Weise. *Zement*, vol. 26, no. 3, Jan. 21, 1937, pp. 39–43. Investigations on influence of cements on shrinkage, elasticity, and strength of road concrete; results of extensive tests carried out over period of 2 years show very slight differences in nine cements investigated.

SEWERAGE AND SEWAGE DISPOSAL

Chlorination. Germicidal Properties of Chlorine Compounds, D. Charlton and M. Levine. *Iowa State College Agriculture & Mechanic Arts—Eng. Experiment Station—Bul.*, no. 132, vol. 35, no. 43, Mar. 24, 1937, 60 pp. Early use of germicidal chlorine compounds; relative germicidal power of chlorine compounds; mechanism of, and factors affecting, germicidal action; experiments with chloramine-T; resistance of B. subtilis spores, dried and non-dried; experiments with hypochlorites; comparison of germicidal powers. Bibliography.

Hospitals. Bio-Filtration at Camarillo, Calif., H. N. Jenks. *Eng. News-Rec.*, vol. 119, no. 5, July 29, 1937, pp. 183–187. Design and functional characteristics of novel single-stage bio-filter installation for complete treatment of strong institutional sewage; recirculation of sewage through rock filter at high rates of flow; layout of 1-mgd treatment plant designed for future enlargement; basic flow data used in design; design characteristics of detention tanks; filtration rates on bio-filter bed; plant operation; cost of complete plant was $84,900.

Irrigation. Municipal Sewage Irrigation, G. A. Mitchell. *Eng. News-Rec.*, vol. 119, no. 2, July 8, 1937, pp. 63–66. Description of sewage irrigation farm scheme at Vineland, N.J., providing since 1928 disposal facilities for 8,000 people and aiding crop production in poor soil; distribution system details; land slope and flow; land preparation and crops; irrigation practice; esthetic considerations; revenue and cost data.

STRUCTURAL ENGINEERING

Dynamic Testing. Dynamic Tests by Means of Induced Vibrations, R. K. Bernhard. *Am. Soc. Testing Matls.—Preprint*, no. 193, mtg., June 28–July 2, 1937, 12 pp. Short report of method of dynamic research in engineering field; various applications of method; few results; various damping and amplifying factors of standard engineering systems considered; advantages and difficulties of method summarized. Bibliography.

Framed Structures, Rigid. Progress Reports Nos. 3, 4, 5 on Stress Distribution in Steel Rigid Frames. *Am. Inst. Steel Construction—Progress Report*, 1937, 28 pp. Results of tests of Specimen No. 2, fabricated by American Bridge Company.

Silos, Pressure Measurement. Direct Measurement of Lateral Pressure on Walls and Bins. *Engineering*, vol. 143, no. 3722, May 14, 1937, pp. 561–562. Form of gage described reads total normal pressure on gage directly by means of spring balance, while it is possible to obtain value of pressure when no movement occurs by taking mean of readings on two gages side by side; constructed and tests carried out in University College of Swansea, under direction of A. A. Fordham.

Towers, Concrete. Edison Memorial Tower for Menlo Park. *Eng. News-Rec.*, vol. 119, no. 7, Aug. 12, 1937, pp. 275–276. Design of original reinforced concrete memorial tower at Menlo Park, N.J., 118 ft high, bearing huge lantern in form of incandescent lamp bulb.

TUNNELS

Construction. Fast Work on Large Shafts. *Eng. News-Rec.*, vol. 119, no. 4, July 22, 1937, pp. 141–144. Speed up methods of construction in excavation of shaft for Queens-Midtown vehicular tunnel under East River at New York City; principal shaft has section about 60 by 112 ft and depth of about 110 ft; power shovels for mucking and heavy surface cranes for hoisting; steel erection; sheeting and bracing; rock excavation.

Water Supply. Fast Tunneling Clinches Sale of Water. *Eng. News-Rec.*, vol. 119, no. 2, July 8, 1937, pp. 59–60. Charleston, S.C., working 1,000 men night and day drives 7-ft tunnel $18^{1}/_{2}$ miles, between August and May, to meet sudden call for water by West Virginia Pulp and Paper Company.

Water Supply, Construction. Marl Tunneling Methods, J. E. Gibson. *Eng. News-Rec.*, vol. 119, no. 2, July 8, 1937, pp. 60–62. Method of driving water-supply tunnel 7 ft in diameter $18^{1}/_{2}$ miles long, for Water Department of Charlston, S.C., at rate of 2.3 miles per month; shaft sinking.

WATER RESOURCES

Surface, Pennsylvania. Stream Flow Records for Year October 1, 1935 to September 30, 1936. *Pa. Dept. Forests & Waters—Div. of Hydrography*, 152 pp., 2 supp. sheets. Stream-gaging records for year ending Sept. 30, 1936; elevations of major floods; flood heights, Ohio River at Pittsburgh.

Underground. Methodes de reconnaissance utilisees pour des travaux de captage d'eaux d'alluvious, R. Joffet. *Travaux*, vol. 21, no. 49, Jan. 1937, pp. 8–12. Review of methods of geological prospecting for underground water supplies in alluvial formations; mineralogical classification of rocks; hydrology and hydraulics of alluvial sands; coefficient of perviousness of alluvial sands.

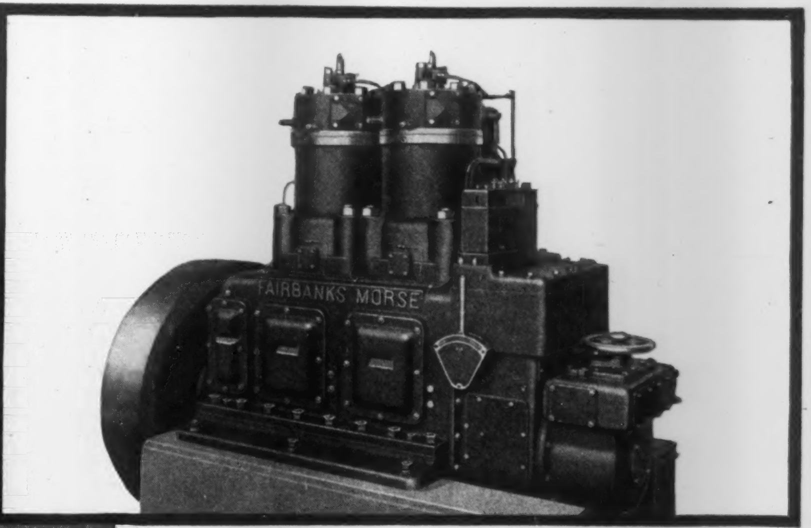
Underground, Mexico. Estudio Geológico de las Pozas de Cuatro Ciénegas, Coah, E. Cepeda and F. Soto Ibarra. *Ingenieria (Mexico)*, vol. 11, no. 4, Apr. 1937, pp. 151–154. Geological study of pools of Cuatro Cienegos in State of Coahuila, Mexico; formations are all of Upper Cretaceous; ground water is origin of many springs; study included determination of flow index and most suitable location of drainage canals to permit maximum utilization of ground waters, to determine porosity of soil and whether ditches should be lined with concrete; sketches of proposed canals; irrigable areas.

WATER TREATMENT

Analysis. Standard Methods and Water Standards, H. E. Jordan. *Paper Trade J.*, vol. 105, no. 7, Aug. 12, 1937, pp. 36–38. Brief history of methods of water analysis dating from early nineteenth century to present accepted standards; test methods now in use; quality standards discussed.

Great Britain. Present-Day Aspects of Purification of London Water Supply, C. H. H. Harold. *Water & Water Eng.*, vol. 39, no. 481, July 1937, pp. 388–400. Autochthonous and allochthonous pollution; London water supply; evolution of methods of purification and chemical and bacteriological control; new works; Thames as source of potable water; treatment; storage, filtration; terminal chloramination; purity of supply. Before Brit. Water Works Assn.

Softening. Ueber die Enthaertung von Trinkwasser in Wasserwerken, H. Haupt and W. Steffens. *Gas- u Wasserfach*, vol. 80, no. 5, Jan. 30, 1937, pp. 72–77. Economic advantages of water softening; comparison of American and German situations and practices with respect to softening of water supplies. Bibliography.



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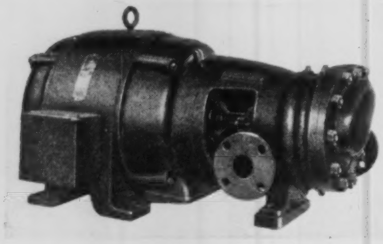
Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

Pump and Motor

A TWO-STAGE built-together pump (pump and motor built together) has been developed by Fairbanks, Morse & Co. to operate against heads up to 500 ft—higher than could be handled by a single-stage unit. In many applications it offers a less expensive alternative for multi-stage and split-case pumps, and its compactness and sturdiness qualify it for portable and semi-portable as well as stationary service.



The new F-M pump is well adapted for service with liquids low in viscosity and free from excessive foreign matter. No special foundation is required; the pump is complete in itself and can be mounted in any convenient position.

This new built-together pump consists essentially of a two-stage centrifugal pump, with enclosed bronze impellers, mounted directly on the shaft of an F-M splash-proof motor. There are no flexible coupling or alignment problems. Two rugged ball bearings take all of the radial and unbalanced thrust loads. Impellers for the two stages are placed back to back, compensating thrust. Improved hydraulic design is attained by placing the first stage unit next to the motor and the second stage on the outside, simplifying the cross-over passage and placing the stuffing-box under suction instead of pressure. A mounting leg under the pump end gives added stability.

Information on this pump will be found in Bulletin 5592, Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill.

Blade Grader

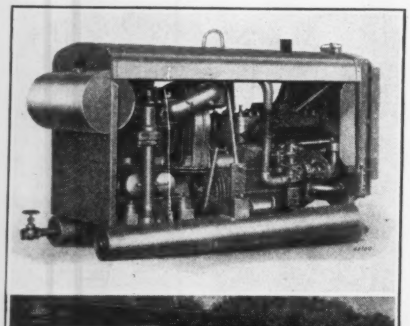
A NEW MODEL No. 33 Blade Grader has been announced by Caterpillar Tractor Co. This machine, equipped with standard 8 ft blade, weighs 5,900 lbs and is similar in general design to the "Caterpillar" No. 44 and No. 66 graders. The machine offers unusual flexibility and rapidity of blade movement. The blade can be moved from a ditching to a high bank cutting position without offsetting the blade on the beams or making any changes in the supporting links. It is not necessary for the operator to leave his platform or stop the tractor. The No. 33 grader is best suited to the "Caterpillar" Diesel RD4 tractor or other tractors of equal hp.

Luminaires

THE REFLECTOLUX Senior is an ornamental luminaire embodying the same light control features as other units of the Reflectolux line of the Westinghouse Electric & Manufacturing Company. It is designed for 300–500 watt lamps on multiple circuits or 4,000 to 15,000 lumen lamps on series circuits. Units for symmetric or asymmetric light distribution are available. These luminaires are especially adaptable for the ornamental type of installation; simple, sharply defined features make the unit as attractive at conventional mounting heights as at close range. A catalog section describing the construction features and application of the Reflectolux Sr. luminaires for street lighting is available from the nearest district office or direct from the Lighting Division, Westinghouse Electric & Manufacturing Company, Cleveland, Ohio.

Utility Compressor

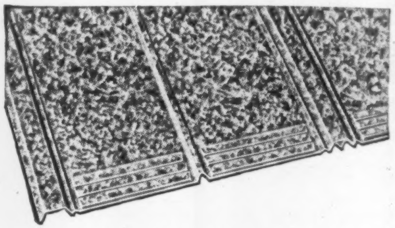
A COMPACT, self-contained utility compressor unit for mounting on a motor truck is illustrated and described in bulletin No. 2320A recently issued by Ingersoll-Rand Company, 11 Broadway, New York, N.Y.



The unit operates independently of the truck motor and transmission. It is usually placed crosswise of the truck body so that it takes up the minimum amount of loading space. Its dimensions are 6 ft 7 in. by 2 ft $3^1/_2$ in., yet it will operate two I-R paving breakers or one I-R 45 lb Jackhamer and one I-R paving breaker. The compactness of the unit allows the truck to be used for the transportation of men or equipment. The unit weighs only 2,100 lbs and is equipped with a lifting bale so that it can be lifted off the truck and put in operation on the ground.

Triple Drain Channel Roofing

A NEW ROOFING product developed by Republic Steel Corporation, Cleveland, Ohio, is being introduced to the market under the trade name of Republic Perfected Triple Drain Channel Roofing. A chief feature of its construction lies in the use of four ridges and three valleys in each channel unit, thus providing three drainage channels instead of the conventional one or two. A beaded channel makes a tight fit at the overlapping edge, creating a vacuum action. Any rain passing this point is carried into the center channel through the action of gravity.



For convenience, the proper area for nailing Triple Drain roofing is indicated clearly by blue lines on each sheet. Triple Drain is available in three types of metal—steel, copper-bearing steel, and rust-resisting Toncan Iron. It is furnished in 26, 28, or 29 gage and in lengths ranging from 5 to 12 ft with a covering width of 24 in.

Pipe Line Welding

LATEST INFORMATION on the construction of pipe lines by electric welding is contained in a new bulletin just published by The Lincoln Electric Co.

The bulletin, entitled "Building Better Pipe Lines Faster at Less Cost by Shielded-Arc Welding," contains 14 pages, $8^1/_2 \times 11$ in., and is profusely illustrated with photographs of pipe lines under construction by electric welding. A brief foreword reviews the progress of electric welding in pipe line construction from 1928 when the first major pipe line was electric welded up to the present time. Following the foreword, there is a short explanation of the modern shielded arc process of electric welding together with a summary of tests of pipe welds made by this process. Data are given in tabular form on important aspects of welding of pipe lines. Tabulated data include: recommended sizes of electrode for pipe line welding, average speed for shielded arc welding, recommended amperage and voltage for various sizes of rod, pounds of electrode per weld, and recommended spacing for pipe.

The bulletin will be found interesting and informative by anyone interested in the subject of pipe line construction, and may be obtained from The Lincoln Electric Company, Cleveland, Ohio.

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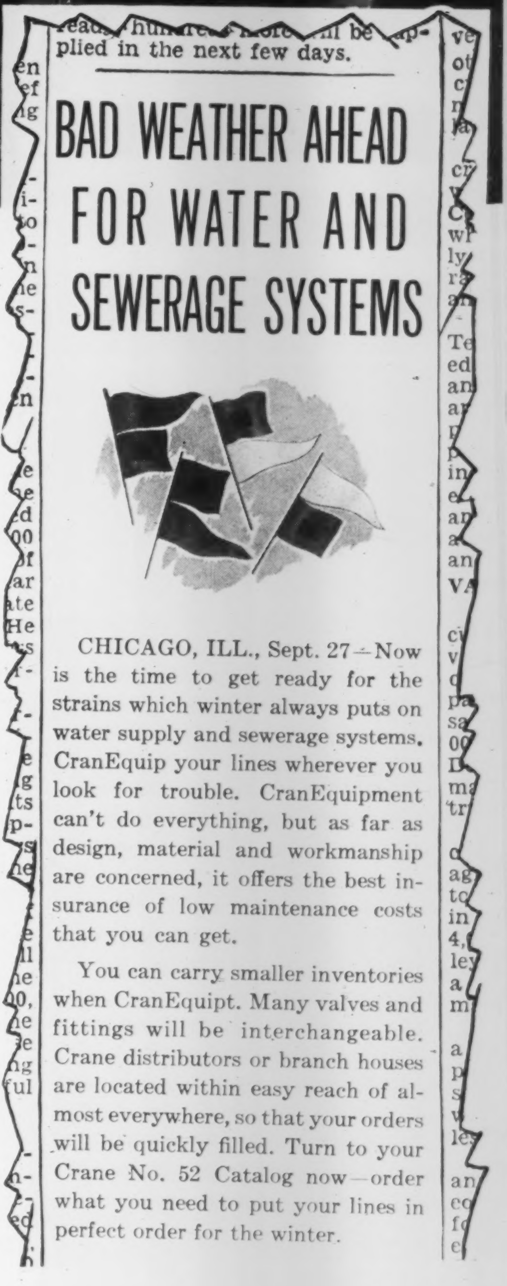

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The low center of gravity makes this heavy machine very easy to handle. It operates on either benzol or aviation gasoline. Ignition is by a 6 volt motorcycle battery carried upon the operator's back and controlled by a push button located on one of the handles. It hops approximately 18 in. vertically and is guided by inclining the machine.

Water Works Manual

A "water works manual," embracing 120 pages of practicable data about Youngstown special wrapped and lined steel water mains, has just been published by The Youngstown Sheet and Tube Company. It has been issued in loose-leaf form, with permanent binder, to facilitate the addition of pertinent facts on various types of pipe, fittings, laying methods, and other data.

The Manual is featured by useful tables and charts covering basic hydraulic information and engineering data used in water main flow capacity and pipe line computations. Subjects discussed include records of service of steel pipe in water mains, corrosion, tuberculation, incrustation, leakage and breakage factors, carrying capacity, cleaning and sanitation, coating and wrapping, linings, couplings and joints, fittings and service connections.

Engineers and officials interested in this field may obtain copies of the Manual by writing to the Water Works Division of The Youngstown Sheet and Tube Company, Youngstown, Ohio.

Folders Announced

Aircraft Products—Booklet A-852, latest publication of John A. Roebling's Sons Co., Trenton, N.J., tabulates the main physical properties needed in the selection of aircraft control cords and cables. Twenty-four pages, with illustrations and specifications.

Arc Welding Equipment—"Welding in Construction Work" in twelve pages, $8\frac{1}{2} \times 11$ in. is an illustrated record of many important recent construction projects which utilized electric welding. The Lincoln Electric Co., Cleveland, Ohio.

Arc Welding Manual—A Revised Arc Welding Manual and Operator's Training Course is offered by Hobart Brothers, Troy, Ohio. Pocket size, 90 pages, divided into chapters on welding equipment, weldability of metals, joints and welds, strength, speed and cost of welding, etc. Price $.50.

Crushers—The C. O. Bartlett & Snow Co., Cleveland, Ohio, announces a new 44-page catalog (No. 77), completely illustrated, giving details of the company's line of crushers, with engineering diagrams, capacity tales, etc.

Diesel Engines—The Caterpillar Tractor Co., Peoria, Ill., has issued a new 32-page booklet, "Places for Power Supplied by 'Caterpillar' Diesel Engines," in which more than 100 specific applications are discussed.

Drill Steels—Users and buyers of rock drill steel may obtain from SKF Steels, Inc., 369 Lexington Ave., New York, N.Y., a 44-page catalog containing much authoritative data, gathered from many sources, presented in a non-technical style.

Electric Integrator—The new electric integrator developed by The Bristol Co., Waterbury, Conn., described in catalog No. 1050, totalizes flow once every 15 sec. Bristol's mechanical and electric flow meters, for measuring the flow of a gas or non-viscous liquid through a closed line, are now equipped with this type of integrator.

Electrodes—Crucible weld electrodes for a-c. welding are described in the three grades and sizes available, and their application to all types of a-c. welding, in a new bulletin released by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Penna.

Gauges—A 24-page catalog of standard gages for rain, snow, and water level, covering an extensive line of instruments for all phases of research into the hydrologic cycle, as well as for industrial applications, is available from Julien P. Friez & Sons, Inc., Baltimore, Md.

Generating Sets—The construction and application of F-M model 36-A Diesel generating sets are described and illustrated in a 14-page bulletin (3600-A2), published by Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, Ill.

Hard-Facing—The fourth printing (in 104 pages) of "Hard-Facing with Haynes Stellite Products" is announced by Haynes Stellite Co., Kokomo, Ind., a unit of Union Carbide and Carbon Corp. Over 500 examples are described, many with photographs.

Metameter—Typical examples of telemetering and remote control are shown in a new bulletin by The Bristol Co., Waterbury, Conn. It explains in diagrammatic form how Metameters measure, transmit, and record readings over a simple two-wire circuit when the transmitter and receiver are any distance apart.

Portable Crushing and Screening Plants—The operation of these plants is described, with complete specifications, by The Austin-Western Road Machinery Co., Aurora, Ill., in bulletin No. 100.

Pumps—Information about Rex modern drum mixers and speed prime pumps, designed and built to meet modern demands for speed and dependability, is given, with pictures taken from various angles, in a new bulletin issued by Chain Belt Co. Milwaukee, Wis.

Snow Plows—Catalog SNP-1, just issued by American Hoist & Derrick Co., St Paul, Minn., gives many valuable facts about the various types of "American" snow plows and wings. Illustrated.

Steel Flooring—Many facts about safe floors and plant safety in general are given in the attractive "4-Way Floor Book," illustrating the application of many types of floor plates and stair treads. Inland Steel Co., 38 South Dearborn St., Chicago, Ill.

Transformers—Electric Tamper & Equipment Co., Ludington, Mich., have issued a new mailing piece covering Jackson portable transformers, which are of core type, air cooled, and Jackson cable assemblies.

Vibration—"Eliminating Vibration Losses," published by The Korfund Company, Inc., Long Island City, N.Y., graphically portrays the application of Korfund Anti-Vibration Products to operating machinery.

Vibrators—Jackson vibrators in action are illustrated and described in a new bulletin published by the Electric Tamper & Equipment Co., Ludington, Mich. Jackson paving tubes are pictured in another folder, and vibrators for spading joints and side forms in paving construction in a third leaflet. "Advantages of Vibration in Concrete Paving" is the title of another publication; a fifth mailing-piece deals with the Jackson Hydraulic Vibrator, and a sixth with high-frequency vibrators.

Welded Piping Systems—The advantages of welded joints in installing piping systems are discussed in "Welded Piping," a 12-page, illustrated booklet which includes sections on economical welding methods; layout, drawings, and specifications; shop and field fabrication, and piping erection. The Linde Air Products Co., New York, N.Y.

Wellpoints—"Pointed Wellpoint Facts," published by Griffin Wellpoint Corporation, 725 East 140th St., New York, N.Y., shows photographs of installations on a variety of construction projects throughout the country.

Wrenches—A new catalog describing their entire industrial line of drop-forged wrenches and other standard stock specialties has been issued by J. H. Williams & Co., 75 Spring St., New York, New York.

Before experimenting with any materials for underground mains—

CHECK THEM AGAINST THESE TEN POINTS OF PROTECTION

☐ **Long Life:** Has it long life? How long? In evaluating bids, cast iron pipe is universally figured at 100 years minimum.

☐ **Internal Pressure:** An average of many internal hydrostatic pressure tests on standard six-inch Class B cast iron pipe shows this pipe withstands more than 2100 pounds pressure per square inch. Another material failed at 290 pounds pressure per square inch.

☐ **Tensile Strength:** Routine specimens cut from standard Class B cast iron pipe show tensile strength ranging from 23,000 to 25,000 pounds per square inch. Another material shows a tensile strength of less than 2,000 pounds per square inch.

☐ **Toughness:** Under hydrostatic pressure and the impact of a 50 lb. hammer, ordinary cast iron pipe does not crack until the hammer is dropped four feet (beginning at one-foot with one-foot increases). Another material fails at one foot (beginning at three-inches with three-inch increases).

☐ **Beam Load:** Under beam stress tests, standard six-inch Class B cast iron pipe bears up under a load of 25,100 pounds and deflects approximately one-inch before breaking. Another material fails at 3760 pounds and deflects one-half inch.

☐ **External Pressure:** In regulation compression tests on a 12-inch section, standard six-inch Class B cast iron pipe withstands a crushing weight of 17,900 pounds. Another material fails at less than 4500 pounds.

☐ **Imperviousness:** The walls of cast iron pipe are impervious to leakage, seepage or sweating of water, gas or chemicals under internal hydrostatic pressure tests. Certain other materials are *not* impervious under similar tests.

☐ **Tight Joints:** For ordinary pressures, cast iron bell-and-spigot pipe—for high pressures, cast iron mechanical joint pipe—have stood the test of time and are known to be leak-proof. Certain other materials require joints yet to be proved.

☐ **Tapping:** Cast iron pipe taps cleanly with strong, tough threads, and loses little in structural strength. No other material withstands tapping as well.

☐ **Flow Capacity:** Under normal conditions, the flow capacity of cast iron pipe remains practically unimpaired for centuries. For the limited areas where active water is encountered, cement-lined or enamel-lined cast iron pipe is available. Under such conditions, no other material offers the combined long life and sustained flow capacity of lined cast iron pipe.

NOTE . . . *Check each point only if you know the material in question meets the requirements with adequate margin of safety. If in doubt, find out before installing.*

Some materials meet some and others meet others but only

CAST IRON PIPE

meets them all

The Cast Iron Pipe Research Ass'n, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Bldg., Chicago

Copeland, George Rogers, Jun., Paxtang, Pa. (Elected Oct. 10, 1927.) (Age 32.) Asst. Director, Pennsylvania State Planning Board, Harrisburg, Pa. Refers to J. B. Babcock, 3d, E. F. Black, W. Bowie, D. E. Davis, H. W. Hemple, P. Kissam, J. W. Mangan, H. A. d'O. Saurbrey, W. Steinbruch, W. L. Stevenson, F. H. Weed.

Dyer, Garvin Henry, Jun., Springfield, Mo. (Elected Oct. 10, 1927.) (Age 32.) Asst. Supt., Springfield City (Mo.) Water Co. Refers to H. C. Beckman, P. Burgess, J. J. Hinman, Jr., L. R. Howson, W. S. Johnson, O. S. Reynolds.

Fossnight, Rex LeRoy, Jun., Erie, Pa. (Elected Oct. 14, 1930.) (Age 29.) Chf. Structural Engr. and Estimator, Erie Concrete & Steel Supply Co. Refers to L. E. Conrad, R. P. Davis, H. R. McBirney, C. P. P. Vetter, M. A. Wilson.

Gelabert D'Elias, Ramon, Jun., Arecibo, Puerto Rico. (Elected Aug. 13, 1934.) (Age 32.) Vice-Pres. and Gen. Mgr., Soller Sugar Co., Inc. Refers to R. R. Casellas, M. Font, E. S. Jimenez, J. D. Morales, R. Ramirez, A. S. Romero, E. Totti y Torres.

Hansman, Arthur Francis, Jun., Oklahoma City, Okla. (Elected Oct. 24, 1932.) (Age 32.) Reinforced Concrete Structural Engr., Capitol Steel & Iron Co. Refers to D. B. Hall, A. Karolak, A. P. Skaer, W. M. Stieve, H. N. Stone.

Hedberg, John, Jun., Palo Alto, Calif. (Elected Jan. 13, 1930.) (Age 31.) Asst. Prof. of Civ. Eng., Stanford Univ. Refers to F. A. Barnes, W. E. Howland, S. B. Morris, C. Moser, L. B. Reynolds, P. H. Underwood, C. L. Walker.

Herzberg, Noble William, Jun., Binghamton, N.Y. (Elected Dec. 9, 1935.) (Age 31.) Asst. Engr., U. S. Geological Survey, Dept. of Interior, Albany, N.Y. Refers to A. W. Harrington, J. C. Hoyt, H. Johnson, J. L. Lamson, C. G. Paulsen, P. R. Speer, B. W. Steele.

Hough, Benjamin Kent, Jr., Jun., Ithaca, N.Y. (Elected Oct. 1, 1928.) (Age 32.) Associate Engr., U. S. Engr. Corps. Refers to W. P. Creager, W. M. Fife, F. P. Fifer, G. Gilboy, S. C. Hollister, J. W. Howard, T. T. Knappen.

Hughes, Leaton Lewis, Jun., St. Louis, Mo. (Elected Oct. 30, 1933.) (Age 32.) Structural Designer, Iowa-Illinois Power & Light Co. Refers to H. E. French, S. G. Gould, C. S. McArdle, J. R. Maher, Sr., L. J. Sverdrup, R. A. Willis.

Jochnowitz, Nathan, Jun., New York City. (Elected Nov. 10, 1930.) (Age 28.) Constr. Engr., Breen Contr. Co., Inc. Refers to R. E. Goodwin, M. Henry, C. M. Madden, J. W. Ridgway, A. Van Siller.

Leermakers, Henry Anthony, Jun., Bethlehem, Pa. (Elected Oct. 1, 1928.) (Age 32.) Jun. Designer, Bethlehem Steel Co. Refers to E. F. Ball, S. W. Bradshaw, E. L. Durkee, W. H. Jameson, J. Jones.

Melby, Grover Odd, Jun., Chicago, Ill. (Elected March 5, 1928.) (Age 31.) Transitman, Pennsylvania R.R. Co. Refers to C. Jenkins, J. F. Mangold, P. D. Miller, H. Penn, J. C. Penn, R. L. Stevens, C. A. Walkwitz, E. Weidemann.

Milliken, Harold Edward, Jun., Auburn, N.Y. (Elected Nov. 14, 1927.) (Age 32.) Chemist and Bacteriologist, City of Auburn. Refers to C. R. Cox, E. Devendorf, G. M. Fair, P. W. Ham, L. Mitchell.

Niederhoff, August Evan, Jun., Los Angles, Calif. (Elected Junior Oct. 14, 1930.) (Age 32.) Engr., U. S. Army Engrs. Refers to H. M. Hill, W. C. Huntington, W. L. Kuehnle, G. E. Lyon, J. W. Woermann.

Stewart, William Paul, Jun., Reading, Pa. (Elected Oct. 1, 1928.) (Age 32.) Senior Constr. Inspector, Pennsylvania Dept. of Highways. Refers to C. H. Buckius, F. L. Castleman, F. A. Heine, R. E. Neumeyer, J. F. Wingo.

Taylor, George Edward, Jr., Jun., Hyattsville, Md. (Elected Dec. 26, 1934.) (Age 27.) Asst. Engr., Washington Suburban San. Comm. Refers to B. E. Beavin, R. L. Burwell, H. R. Hall, A. N. Johnson, S. S. Steinberg.

Toma, Jameel Shammas, Jun., Baghdad, Iraq. (Elected May 25, 1931.) (Age 32.) Engr., Land Reclamation, filling in swamp land around city for Iraq State Rys. Refers to T. R. Camp, J. W. Howard, C. M. Spofford, H. Sutherland.

Van Houten, Robert Wallace, Jun., Maplewood, N.J. (Elected June 26, 1931.) (Age 32.) Asst. Prof. in Civ. Eng., Newark Coll. of Eng. Refers to H. N. Cummings, C. W. Dunham, H. A. Haufler, W. S. LaLonde, Jr., A. P. Richmond, Jr., W. A. Stickel.

White, Harry Edwin, Jun., Penrose, Colo. (Elected Oct. 24, 1932.) (Age 32.) Jun. Engr., Bureau of Reclamation, U. S. Dept. of Interior. Refers to C. Harvey, A. W. Kidder, A. A. Lewis, H. R. McBirney, C. P. P. Vetter.

Williamson, Edwin Paul, Jun., Pekin, Ill. (Elected Oct. 14, 1929.) (Age 32.) Inspector (Constr.), U. S. Engr. Area Office, Peoria, Ill. Refers to J. N. Bradley, E. H. Coe, J. J. Doland, W. C. Huntington, L. P. Murphy, D. G. Shockley, M. Suter.

Winbland, Jeff Andrew, Jun., Denver, Colo. (Elected Oct. 24, 1932.) (Age 32.) Associate Engr., Bureau of Reclamation. Refers to A. W. Kidder, H. R. McBirney, R. Sailer, J. L. Savage, C. P. P. Vetter.

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

Men Available

These items are from information furnished by the Engineering Societies Employment Service, with offices in Chicago, New York, and San Francisco. The Service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 87 of the 1937 Year Book of the Society. To expedite publication, notices should be sent direct to the Employment Service, 31 West 39th Street, New York, N.Y. Employers should address replies to the key number, care of the New York Office, unless the word Chicago or San Francisco follows the key number, when it should be sent to the office designated.

CONSTRUCTION

Civil Engineer; Assoc. M. Am. Soc. C.E.; 51; B.S.C.E., Massachusetts Institute of Technology; married. Thorough experience, structural design, office and industrial buildings, heavy foundations, hydroelectric plants, boiler and power plants, and (especially) iron and steel plants; 13 years as resident engineer on construction of plants for latter industry. Employed but available on short notice. C-166-9219 Chicago.

DESIGN

Structural Engineer; M. Am. Soc. C.E.; M-ACI.; graduate of New York University, B.S.C.E.; licensed professional engineer, New York and Pennsylvania. Long, varied, and successful experience in design of reinforced concrete for buildings; 5 years in continuous employ of one architectural firm; can take charge of preparation of plans; excellent references. Location preferred New York, but will go elsewhere. C-186.

EXECUTIVE

Engineer; Assoc. M. Am. Soc. C.E.; age 35; 13 years experience in industrial engineering and city management. Trained in civil engineering and political science. Experienced in public relations, personnel, purchasing, and finance. Able surveyor, draftsman, designer, and administrator. Possesses tact and ability to inspire confidence. Prominent references. Licensed engineer; member of leading societies. C-161.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 37; married; 8 years principal assistant consulting engineer, irrigation and reclamation. Design and construction of gravity, pipe-line, sub-irrigation, and pumping irrigation projects. Construction, design, telephone, and power projects. Proficient in cost analysis. Broad agronomy experience. Prefers to be west of Rocky Mountains. Available immediately. C-165-379-A-1 San Francisco.

Civil Engineer; Assoc. M. Am. Soc. C.E.; age 48; married; graduate of University of Wisconsin. Has been in charge of design and construction of utilities for industrial plants, streets, sewers, water supply, and hydraulic machinery. Experienced also in surveys, investigations, and estimating. Now employed but desires change to firm of consultants or contractors. C-170.

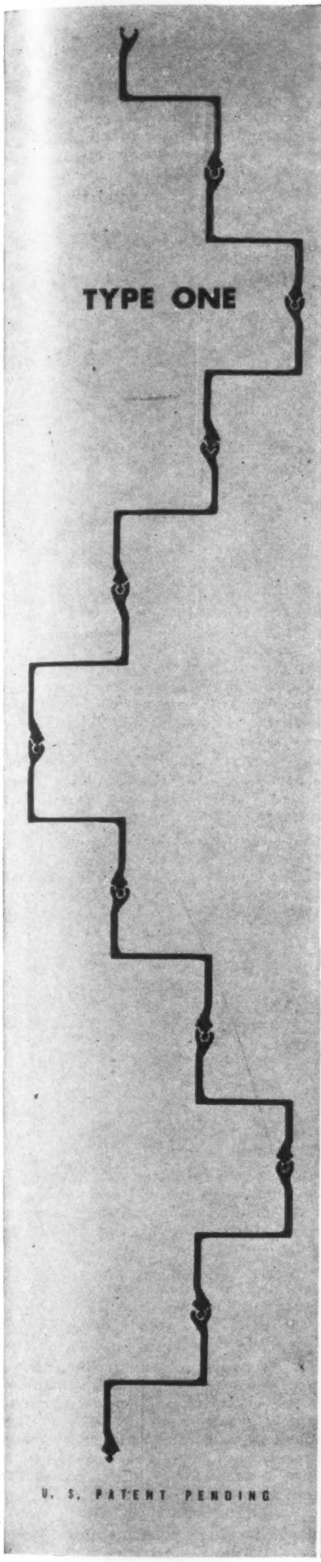
Engineer-Executive; Assoc. M. Am. Soc. C.E.; technically trained; 45; wide experience in mining and construction in United States and Latin America. Fluent in Spanish; knows French. Has assisted on several notable mining explorations and developments, and managed two operations with entire success. Specially skilled in open-pit layouts, mining and industrial appraisals, and Latin-American projects. C-175.

Water Works Manager and Engineer; M. Am. Soc. C.E.; registered in Pennsylvania and West Virginia; 27 years experience designing, construction, and operation; can handle design, purchase of material and equipment, and management of operation. Valuation experience with public service commission. Now available; location anywhere, but South preferred. C-177.

Structural Engineer; Assoc. M. Am. Soc. C.E.; graduate; licensed; over 20 years experience, bridges, buildings, sewage-disposal and water-filtration plants, rigid frames; 6 years in charge of design; 5 years as superintendent of construction; 3 years teaching at state university. Desires permanent executive position, America or British Isles. C-181.

Civil Engineer; M. Am. Soc. C.E.; former chief structural engineer, Philippine government, Manila, and George A. Fuller Company, Tokyo, Japan; for past 7 years structural engineer for federal government, supervising architect, Washington, D.C. Speaks Spanish, some German, French, and Japanese. Capable of preparing all plans and supervising building construction. Foreign service preferred. C-183.

Civil and Hydraulic Engineer; M. Am. Soc. C.E.; 46; graduate; married; 25 years experience, including 14 years private practice; 2 years with Corps of Engineers, U. S. Army; 4 years on PWA investigations and reports, flood control, water supply, water power, and mines;



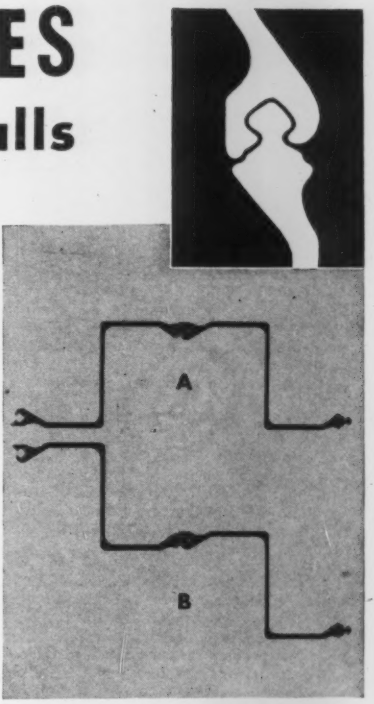
Announcing-
TWO NEW TYPES
of Sheet Piling Walls

Less than seventeen months ago Carnegie-Illinois announced the first Z-piling produced in America . . . MZ-38 and MZ-32, which provide approximately 2½ times greater wall strength per pound of steel.

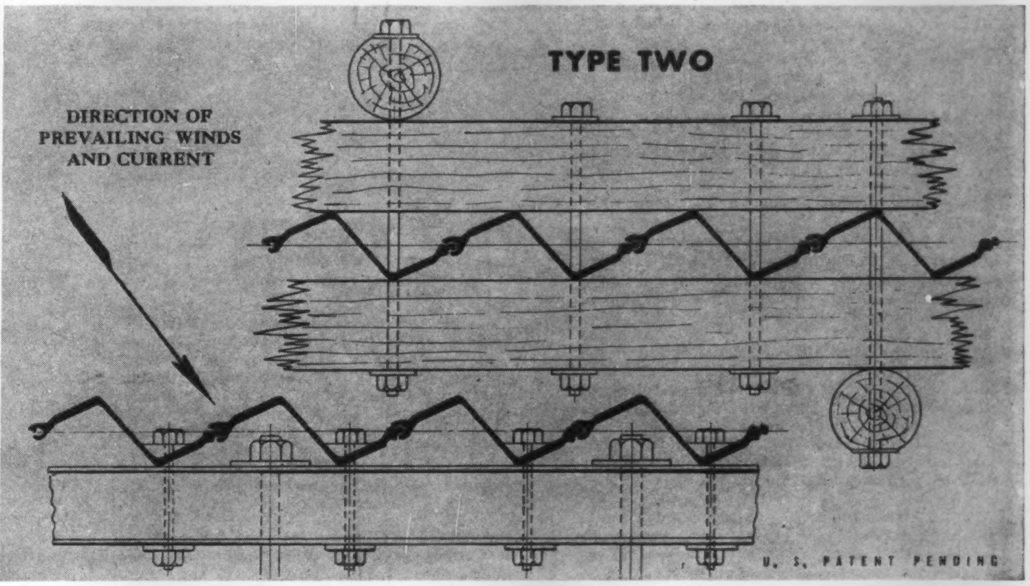
Today we offer a new step-type wall and a new zig-zag wall produced by taking advantage of the fact that the interlock has been made reversible. This permits MZ-38 and MZ-32 to be driven either in the usual standard sequence, "A" (where successive sections are reversed) or in a new sequence, "B" (where sections are similarly oriented).

The new step-type piling wall (at left) combines both old and new section sequences "A and B" to provide considerably greater strength with no increase in amount of piling needed.

The new zig-zag piling wall (below), with sections in "B" sequence, can be used advantageously in seawalls or groyns wherever abrasive attack of steel due to current or wave action may be expected. Such a wall, having ½" thick flanges facing the direction of the current or prevailing winds, will increase life expectancy of structure 33-1/3% . . . at no additional cost. (This wall in MZ-32 has a section modulus of 10.6 in^3, weighs 29 lbs. per sq. ft. of wall. Pile width is 23⅛".)



Write us for details—we'd be glad to help you save money for your clients with this economical construction.



U·S·S STEEL SHEET PILING

CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh *Chicago*
Columbia Steel Company, San Francisco, *Pacific Coast Distributors* United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

valuation and expert testimony. Location in southeastern states, preferably Georgia. C-184.

JUNIOR

CIVIL ENGINEER; Jun. Am. Soc. C.E.; age 29; married; B.S.C.E., Purdue University; construction experience in oil refinery work, transitman, and drafting; desires position with construction firm. Willing to go anywhere for a good position and particularly anxious to continue in construction field. Available immediately. C-163.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; age 30; graduate of Columbia University (B.A. in physics and chemistry) and University of Colorado (civil engineering); desires position in technical sales or writing work after four years general and highway construction and three years personnel, statistical, general office, and free-lance writing. C-162.

YOUNG GRADUATE CIVIL ENGINEER; Student Member; desires position with engineer or builder doing either office or field work. Previous experience with large construction company doing field layout for buildings, sewers, and other underground conduits; also did work as assistant superintendent, material clerk, and timekeeper. Location immaterial. Willing to travel. C-167.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 23; single; B.S.C.E. from Rhode Island State College; experience with Corps of Engineers, U. S. Army, as engineering aide (general office work and junior draftsman). Interested in sanitary engineering. Would like experience on construction or survey work. Location, United States. Available. C-168.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; graduate in civil engineering; graduate business administration; Mem. Soc. Amer. Mil. Engrs.; lieutenant, Corps of Engineers, U. S. Army; 10 years experience in construction design, drafting, and surveying. Desires permanent connection. C-169.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 27; married; B.S. in C.E., Georgia School of Technology, 1934; 1½ years party chief, Geodetic Survey; 1 year general engineering (water system, sewage system, disposal tanks construction); also experience in highway and pipe-line construction; drainage. Desires position with engineering or industrial firm. C-171.

YOUNG ENGINEER; Jun. Am. Soc. C.E.; 24; B.S.E. and M.S.E., College of the City of New York. Had six months field assistant fellowship in surveying at aforementioned institution. Desires start with large contractor. Will travel. Has knowledge of Spanish. Experience and future important. Available immediately. C-172.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; B.S. in C.E., Cooper Union, 1935. One year as rodman on precise city survey; one year as steel designer for consulting engineer. Special research in, and author of articles on, indeterminate structures. Employed, but job completed. Available immediately. C-174.

ENGINEER; Jun. Am. Soc. C.E.; 32; married; C.E., Rensselaer Polytechnic Institute, 1928; 9 years experience in engineering department of large oil refinery; 3 years field engineering, estimating, construction, and cost control work; 6 years testing materials and equipment; fair knowledge of Spanish; desires more responsible position with greater opportunities. C-173.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; single; B.S. in C.E.; 1 year as 2d lieutenant, infantry, U. S. Army (Thomason Act); approximately 4 months plane-table work; desires permanent position in sanitary engineering or construction; free to travel anywhere; available on short notice. C-176.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 24; single; B.S. in C.E., Cooper Union, June 1936; fine scholastic record; desires opportunity in any branch of civil engineering. C-178.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 26; single; B.S.C.E., University of Kentucky, 1931; 6 months experience as structural detailer for large fabrication company; 5½ years highway experience; 1 year field experience on construction and location; 4½ years in central office as engineering draftsman and estimator. Desires position with future, not necessarily in line with past experience. C-180.

CONCRETE ENGINEER; Jun. Am. Soc. C.E.; 26; married; member American Concrete Institute; B.S. in C.E.; member Tau Beta Pi; 1½ years experience concrete inspection; 3½ years in concrete testing, design, control, and research. Location immaterial. Desires position as concrete engineer, concrete technician, or assistant. C-179.

CIVIL ENGINEER; Jun. Am. Soc. C.E.; 23; B.S.C.E., cum laude, New York University, 1936. One year on faculty of New York University as graduate assistant and Duryea Fellow; one year graduate study in hydraulic and sanitary engineering; 3 months experience as sanitary engineer for Kellogg Foundation. Location New York City. C-182.

SALES

SALES ENGINEER; M. Am. Soc. C.E.; registered in Pennsylvania. Over 20 years experience in engineering, production, and sales of steel fabrication, also general construction. Prefers western Pennsylvania and adjacent territory. C-185.

TEACHING

CIVIL-HYDRAULIC-CONSTRUCTION ENGINEER; Assoc. M. Am. Soc. C.E.; married; 35; B.Sc.; M.Sc.; Chi Epsilon; California Junior College teachers certificate; 6 years teaching mechanics, hydraulics, surveying; 8 years analysis, design, construction of hydraulic works, and highways. Now employed. Permanent position with engineering-contracting firm or university with opportunity desired. C-164.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1937. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

ENGINEERING MECHANICS, DYNAMICS. By S. Timoshenko and D. H. Young. New York and London, McGraw-Hill Book Co., 1937. 323 pp., diagrs., charts, tables, 9 × 6 in., cloth, $2.75.

This elementary textbook on dynamics is intended to give the student a thorough grounding in fundamentals. The choice of material has been made with the object of acquainting the student with many general methods of attack, and to illustrate the application of these methods to practical engineering problems. Vibration problems, elliptic harmonic motion, and relative motion are covered. This material, however, may be omitted without producing discontinuity in the text.

ENGINEERING PROBLEMS MANUAL, 3 ed. By F. C. Dana and E. H. Willmarth. New York and London, McGraw-Hill Book Co., 1937. 313 pp., diagrs., charts, tables, 8 × 5 in., cloth, $2.25.

A textbook for use in courses on engineering problems which have for their object the training of the engineering student in good habits of work and study. The first seven chapters provide information that will furnish a groundwork for this training. Chapter VIII presents some three hundred practical review problems, and miscellaneous tables helpful in solving them are given in Chapter IX.

GRUNDLAGEN DER FLUGZEUGNAVIGATION, 3 ed. By W. Immler. Munich and Berlin, R. Oldenbourg, 1937. 178 pp., illus., diagrs., charts, tables, 11 × 8 in., paper, 12 rm.

In this treatise on the principles of aerial navigation, there is a brief discussion of maps and charts followed by a large section on finding and holding a course, covering the compass and other navigation instruments, the use of maps and charts, and the influence of and allowance for wind pressure. The next two sections cover terrestrial and astronomical position finding. There are tables, sample charts, and a short chapter on long-distance navigation.

HOW TO MAKE ALIGNMENT CHARTS. By M. G. Van Voorhis. New York and London, McGraw-Hill Book Co., 1937. 114 pp., diagrs., charts, tables, 9 × 6 in., cloth, $2.50.

A practical implement for engineers and designers, showing how to make nomographic or alignment charts for the solution of engineering and other formulas. The treatment is arranged so that equations or formulas may be matched with listed type forms and the nomogram constructed by following concisely stated directions accompanied by illustrations. A brief outline of theory is given in the appendix.

(The) PSYCHOLOGY OF SELECTING EMPLOYEES, 3 ed. By D. A. Laird. New York and London, McGraw-Hill Book Co., 1937. 316 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $4.

This practical treatment of the fundamental considerations in selecting men gives a comprehensive picture of psychological means and methods of selecting employees, and shows the employer how to find efficient employees in his own establishment, as well as in his employment office. The application of psychological principles in actual employment work is explained.

(The) RAILWAY INTERRELATIONS OF THE UNITED STATES AND CANADA. By W. J. Wilgus. New Haven, Yale University Press, 1937. 304 pp., maps, tables, 10 × 7 in., cloth, $3.

This is a study of the influence of the railways of the two countries for their common good and the cause of peace. The author first sketches the physical characteristics of the two countries and then gives the historical development of the fifty rail gateways along the border. A discussion of traffic flow is followed by an outline of the elements affecting the joint service and joint-rate situation of the interrelated railways. A short résumé directs attention to the things necessary for future advances in transportation for the benefit of both countries. Special appendixes and a complete index add to the value of the book.

(A) SAGA OF THE SEAS. By P. B. McDonald. New York, Wilson-Erickson, 1937. 288 pp., illus., 10 × 6 in., cloth, $3.

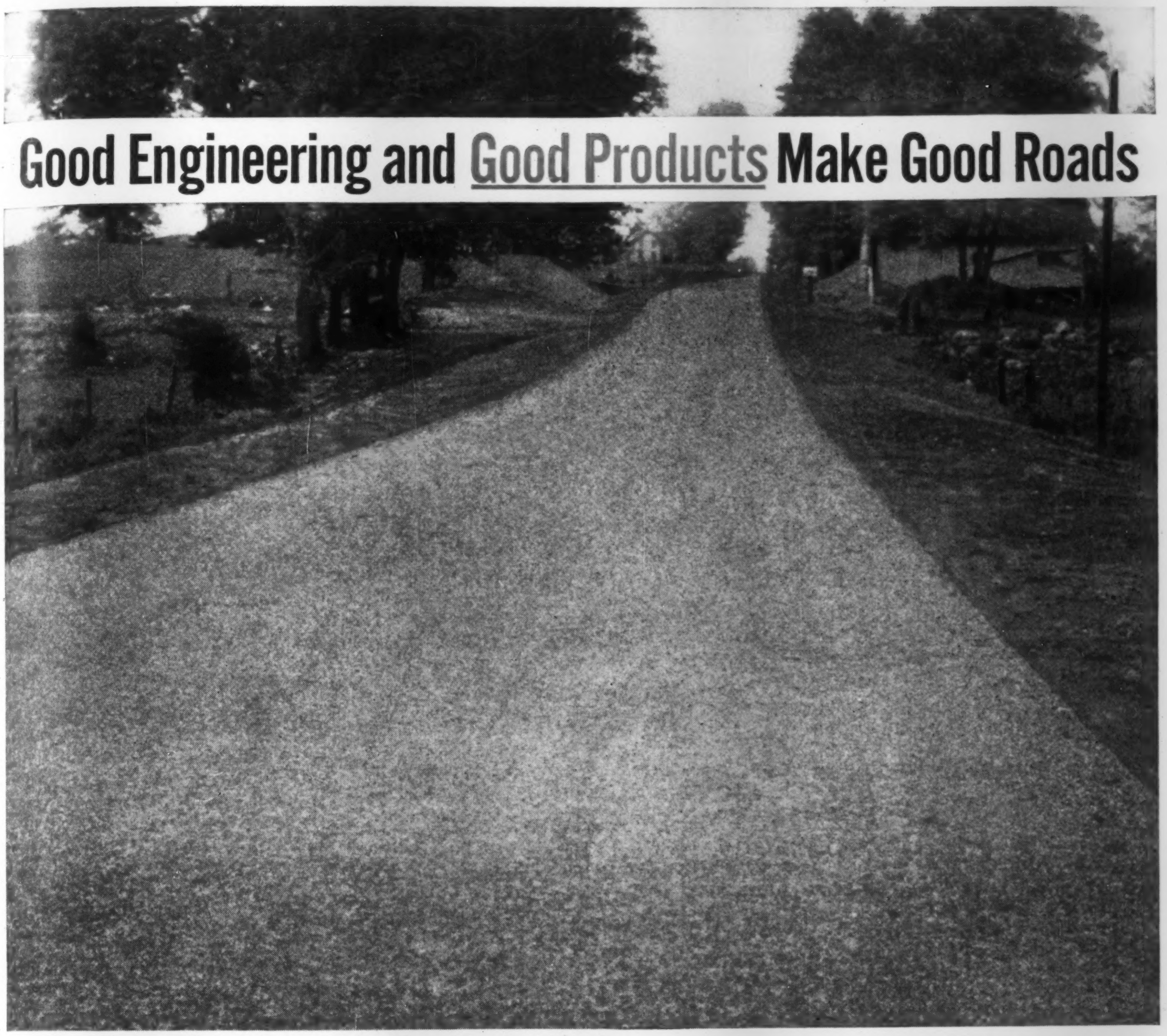
The major part of this biography of Cyrus W. Field is devoted to his greatest achievement, the laying of the first Atlantic cable. The volume is illustrated with contemporary prints and portraits.

TRINKWASSER AUS TALSPERREN. By A. F. Meyer. Munich and Berlin, R. Oldenbourg, 1937. 183 pp., illus., diagrs., charts, tables, 10 × 7 in., cloth, 14 rm.

This is a discussion of drinking-water supply as obtained from reservoirs formed by dams. It covers the development and future significance of such supply, selection of the catchment basin and technical preparation of the site, dam construction operations, and the supervision and maintenance of such supply works, including the treatment of the water.

Mitteilungen des Forschungsinstituts für Maschinenwesen beim Baubetrieb. Heft 10, ed. by G. Garbotz. VERGLEICHENDE UNTERSUCHUNGEN ÜBER DIE STATISCHEN, KONSTRUKTIVEN UND RAMMTECHNISCHEN EIGENSCHAFTEN DER VERSCHIEDENEN DEUTSCHEN SPUNDWANDSYSTEME. By W. Haack. Berlin, VDI-Verlag, 1937. 62 pp., illus., diagrs., charts, tables, 12 × 8 in., paper, 15 rm.

This report describes an elaborate investigation of the comparative properties of four types of steel sheet-piling. The static and structural properties and behavior during driving were carefully studied, and much light was thrown upon the merits of the various forms. There is a bibliography.



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BRIDGES

Suspension, Design. Calcul du pont suspendu à poutres continues, Bachet. *Travaux*, vol. 21, no. 51, Mar. 1937, pp. 113–119. Theoretical mathematical discussion of design of suspension bridges with continuous stiffening girders.

Suspension, London. Reconstruction of Chelsea Bridge, London. *Engineering*, vol. 143, no. 3721, May 7, 1937, pp. 519–522; see also *Engineer*, vol. 163, no. 4243, May 7, 1937, pp. 541–544. New bridge across river Thames takes place of suspension structure in service since 1858; overall length 698 ft and overall width 83 ft; it carried 40-ft carriageway and two footways; though bridge is of suspension type, cables are fastened to ends of stiffening girders, which support deck instead of being secured to usual anchorages at each end.

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Exhibition, Cleveland. Rigid-Timber Frames in Cleveland Exposition Building Utilize Stressed Plywood, C. M. Barber. *Construction Methods*, vol. 18, no. 8, Aug. 1936, pp. 34–35. Use of rigid-timber frames made up of nailed box-section columns and girders, utilizing plywood as cover plate material, providing structural backbone of Hall of Progress, 540 ft long by 210 ft wide, at Cleveland's Great Lakes Exposition; models tested.

Soundproofing. Acoustics in Buildings, A. J. Davis. *Surveyor*, vol. 91, no. 2355, Mar. 12, 1937, pp. 407–408. Echoes and reverberation; noise in buildings; partitions; doors and windows; floors and ceilings; ventilating ducts and water pipes.

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Testing, Weathering. Weathering Resistance of Concrete, E. J. Kilcawley. *Rensselaer Polytechnic Inst. Bul.—Eng. & Science Series*, no. 53, Mar. 1937, 83 pp. Completion of report on compression strength tests of concrete in study where 10 per cent of cement was replaced with colloidal clay, also, results of weathering and permeability tests run on same kind of concrete; compressive tests have been made on 3 by 6-in., 28-day, and 2-year specimens, and permeability tests on 3 by 6-in., 1-year, and 2-year specimens.

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Earth, Colorado. Thin-Core High Earth Dam, O. M. Strange. *Eng. News-Rec.*, vol. 119, no. 5, July 29, 1937, pp. 195–199. Design and construction of rolled earth-fill dam, 200 ft high, 25 ft wide and 1,150 ft long, near Denver, Colo.; unusual spillway design; placing fill; rains slow up work; tunnel and spillway work; construction progress.

Hydraulic Fill, Montana. Missouri River Blocked at Fort Peck, C. H. Chorpening. *Eng. News-Rec.*, vol. 119, no. 4, July 22, 1937, pp. 153–156. Unexpected slide threatening vital railroad bridge and nearly wrecking carefully planned diversion procedure; rapid shifting of closure to downstream toe successfully turns river and avoids possible year's delay in construction of big earth fill.

Multiple Arch, Buckling. La stabilite au flambement des grands barrages a contreforts, R. Chambaud. *Travaux*, vol. 21, no. 50, Feb. 1937, pp. 69–77. Theoretical mathematical study of buckling stresses in buttresses of high multiple-arch dams; numerical example illustrating computation of stability of large counterforted dam.

Rock Fill, California. San Gabriel Dam Completed. *Eng. News-Rec.*, vol. 119, no. 5, July 29, 1937, p. 167. Brief history of San Gabriel rock-fill dam No. 1, of Los Angeles County Flood Control District, having total height of 355 ft.

Spillways, Construction. Interesting Construction at Horse Mesa Dam, R. T. Larsen. *Reclamation Era*, vol. 27, no. 6, June 1937, pp. 132–135. Construction of spillway at Horse Mesa Dam (305 ft high), Arizona, with reservoir always practically full; spillway will have sheer drop of 200 ft directly on to river bed.

United States. Thirty-Five Years of Dam Construction, W. I. Swanton. *Reclamation Era*, vol. 27, no. 6, June 1937, pp. 124–126. Review of dam construction by U. S. Bureau of Reclamation and its predecessor (the U. S. Reclamation Service) since 1900.

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California. Desert Menace in San Joaquin. *Eng. News-Rec.*, vol. 119, no. 8, Aug. 19, 1937, pp. 299–303. Description of Central Valley irrigation project of California, outlining menacing conditions which project is designed to correct; complex factors involved in work; long-range planning; state and federal partnership; by-product power; Central Valley data. Bibliography.

MATERIALS TESTING

Concrete, Deformation. Concrete Creep Data, A. D. Ross. *Structural Engr.*, vol. 15, (new series) no. 8, Aug. 1937, pp. 314–326. Review of recent studies, including author's experiments, on non-elastic deformation of concrete under sustained load; creep-time equations; determination of constants; creep over long periods; variables affecting creep; forecast of creep; creep after shorter periods. Bibliography.

Framed Structures, Rigid. Progress Report Nos. 6, 7, 8 on Stress Distribution in Steel Rigid Frames. *Am. Inst. Steel Construction—Progress Report*, 1937, 20 pp. Further tests of Specimen No. 1, fabricated by Bethlehem Steel Company.

PORTS AND MARITIME STRUCTURES

Deterioration. Deterioration of Marine Structures, J. Purser. *Instn. Civ. Engrs. Ireland—Trans.*, vol. 62, 1936, pp. 121–138, (discussion) 139–157. Review of data on deterioration of port structures of timber, masonry, cast iron, wrought iron, steel, concrete, and reinforced concrete; paints and other protective media.

Sandy Beaches. Haefen an sandigen Kuesten, Schuette. *Werft-Reederei Hafen*, vol. 18, no. 3, Feb. 1, 1937, pp. 37–41. Port structures on sandy beaches; report on discussion at International Navigation Congress in Brussels 1935, concerning structures and means of maintaining water depth in harbors on sandy beaches and estuaries; description of some harbors; conclusions; maps of various harbors presented.

Shore Protection, Germany. Asphaltbauweisen im Dienste des Kuestenschutzes, F. Joedicke. *Bauingenieur*, vol. 18, nos. 3/4, Jan. 22, 1937, pp. 31–35. New German practice in use of asphalt for revetment of sea dikes, walls, and embankments.

Wilhelmshaven, Germany. Anlage und Entwicklung des Hafens von Wilhelmshaven, Pein. *Werft-Reederei Hafen*, vol. 18, no. 10, May 5, 1937, pp. 130–134. Development of port of Wilhelmshaven, Germany; plans of harbor presented showing status of developments in 1853, 1873, 1900, and 1921; description of harbor structures and equipment.

ROADS AND STREETS

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Snow Control. Snow Drift Control on Highways, E. A. Finney. *Can. Engr.*, vol. 72, no. 10, Mar. 9, 1937, pp. 7–9. Designs for control of drifts; types of snow fences; results of wind-tunnel tests on fencing; methods of tree planting; shrub planting for snow control.

Snow Removal. Die Offenhaltung der schweizerischen Alpenpoststrassen im Winter, W. Hamacher. *Verkehrstechnik*, vol. 18, no. 11, June 5, 1937, pp. 277–280. Review of Swiss snow-removal practice for maintenance of winter traffic on Alpine roads; types of snow plows in use.

South Africa. Aspects of Rural Highway Surfaces, T. P. Fox. *Instn. Mun. & County Engrs.—J.*, vol. 63, no. 7, Sept. 29, 1936, pp. 484–506, (discussion) 506–514. Review of South African experience with surface treatment of country roads; standard designs.

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Stabilization, Binder. Road Stabilization with New Binder. *Contractors & Engrs. Monthly*, vol. 34, no. 6, June 1937, pp. 20 and 35. Experience of highway departments of states of Washington and New Jersey with use of lignin liquor, by-product of manufacture of rayon pulp, as road binder for stabilization; characteristics of binder; specifications; preparation of road surface; costs.

Subsoils. Subgrade Soils, Their Analysis and Drainage, D. J. Emrey. *Can. Engr.*, vol. 72, nos. 16 and 19, Apr. 20, 1937, pp. 11–14, and May 11, pp. 15–17. April 20: Plasticity index and

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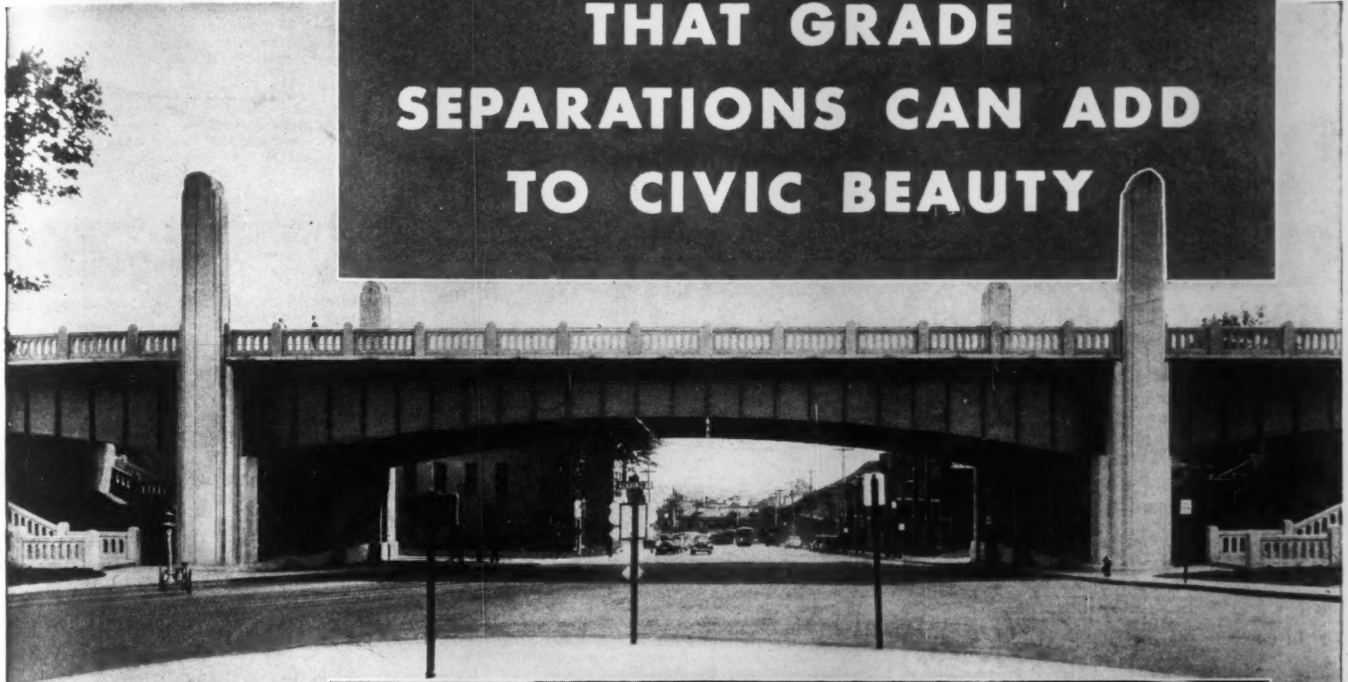

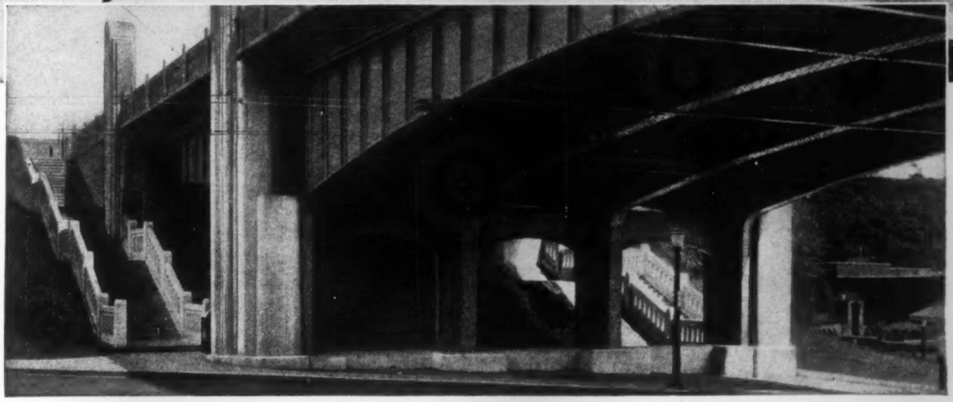

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its importance in subgrade stability; shrinkage limit and moisture equivalent of subgrade soils. May 11: Treatment of non-uniform subgrades; analysis of subgrade soils in Waterloo County, Ontario, and their respective behavior. Before Road Superintendents' Conference in Toronto. (Concluded.)

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RECENT DATA. Reference and Data Section, L. H. Enslow. *Water Works & Sewerage*, vol. 84, no. 5, May 1937 (adv. sec.) pp. 111–308. Data on design, construction, operation, and maintenance of water works and sewerage systems selected from previously indexed articles published in *Water Works Sewerage* and from other sources; latest hydraulic tables and standards presented.

SEWERS, CONCRETE. Again Proving Weakness of Concrete as Drainage Sewer Pipe. *Brick & Clay Rec.*, vol. 91, no. 1, July 1937, p. 21. Review of book by H. Bronneck which details acids in sewage that destroy structure of concrete.

SEWER TUNNELS. Tunnel Looped Under a Fault. *Eng. News-Rec.*, vol. 119, no. 6, Aug. 5, 1937, pp. 220–224. Construction of subaqueous sewer tunnel under East River, New York City, for Wards Island 180-mgd sewage plant; bad rock first struck by New York sewer tunnel bypassed by sinking subshafts and dropping center section 220 ft lower; driving bore; lining methods; supervision.

SEWER TUNNELS, CONSTRUCTION. High Speed Shield Tunneling. *Eng. News-Rec.*, vol. 119, no. 5, July 29, 1937, pp. 188–191. Record speed of 50 ft per 20-hour day maintained in advancing 22-ft shield through soft clay under compressed air on Detroit interceptor sewer tunnels; shield driving; shoving cycle; dumper handling of muck cars; monolithic lining; shaft and top plant; sideslip causing settlement.

SLUDGE DIGESTION. Studies in Digestion of Ground Garbage, W. L. Malcolm. *Sewage Works J.*, vol. 9, no. 3, May 1937, pp. 389–405. Digestion of sludge and garbage to ascertain if ground garbage alone, or combinations of ground garbage and raw sludge, would digest, if digestion units were seeded with well-digested sludge; gas production; pH of tank sludges. Bibliography. Before N.Y. State Sewage Works Assn.

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BEAMS, BUCKLING. Notes on Stability of Columns and Beams, A. N. Procter. *Structural Engr.*, vol. 15, (new series) no. 9, Sept. 1937, pp. 350–367. Mathematical discussion of theoretical and practical aspects of elastic stability; effect of combined bending and compression on slender structural unit; effect of curvature, twists, and eccentric loading on laterally unsupported beam; tests on small rolled steel joists; variation of stress along length of column or beam; local buckling of plates and flanges due to direct compression; torsion of I-beams. Before Instn. Structural Engrs.

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FRAMED STRUCTURES, STRESS ANALYSIS. Solution of Completely Redundant Portal Frames, S. J. E. Moyes. *Engineering*, vol. 143, no. 3726, June 11, 1937, pp. 653–655. Description of method, with examples, which can be applied to all cases of loading without exception, there being no need to break down loading into simpler cases; general equations, according as to whether loading is vertical or horizontal, are evolved.

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TUNNELS

VIADUCTS, BALTIMORE, MD. Baltimore Builds a Viaduct, G. J. Requardt and H. J. Lucke, Jr. *Eng. News-Rec.*, vol. 119, no. 4, July 22, 1937, pp. 133–135. History and description of recently completed Orleans St. reinforced concrete viaduct in Baltimore, Md.; 2,075 ft long; roadway 54 ft wide; 49 ft maximum height.

VIADUCTS, CONCRETE. Maintenance and Repair of Concrete Structures in Railroad Construction, M. Hirschthal. *Am. Concrete Inst.—J.*, vol. 18, no. 3, Jan.–Feb. 1937, pp. 251–278. Experience of Delaware, Lackawanna, and Western Railroad with maintenance and repair of long-span concrete viaducts, short-span concrete arch bridges, and railroad crossings; durability of concrete; examination of structures; repair work; specifications for concrete repair work.

VIADUCTS, CONCRETE ARCH. Autobahnbruecke ueber das Brunnental bei Helmstedt, K. von Scanzoni. *Bauingenieur*, vol. 18, nos. 9/10, Mar. 3, 1937, pp. 97–103. Design and construction of concrete-arch highway viaduct over Brunnen Valley at Helmstedt, Germany, having total length of 163 m, maximum span of 27.9 m.

VIADUCTS, PLATE GIRDER. Der Taluebergang Bergen der Reichsautobahn Muenchen-Salzburg, H. Boerner and H. Lettner. *Bauingenieur*, vol. 18, nos. 5/6, Feb. 5, 1937, pp. 53–61. Design and construction of Bergen plate-girder viaduct on German superhighway between Munich and Salzburg, having total length of 345 m, maximum span of 65 m, and maximum elevation above valley floor of 42 m; width of roadway including two sidewalks is 21 m.

WATER PIPE LINES

CROSS CONNECTIONS. Praktische Erfahrungen mit Rohrunterbrechern und Druckspuelern, A. Krull. *Gas- u Wasserfach*, vol. 80, no. 4, Jan. 23, 1937, pp. 56–58. Description of appliances for prevention of contamination of drinking-water pipe lines with impure waters.

DISINFECTION. Disinfection of New Water Mains, R. M. Harris. *Eng. News-Rec.*, vol. 119, no. 4, July 22, 1937, p. 146. Disinfection of new and repaired water mains before they are placed in service; contamination of new mains laid in Port Orchard, Wash.; field investigations; possible causes of main contamination. Abstract of paper before Am. Water Works Assn.

FOUNDATIONS. Mattress Holds Five 48-Inch Mains on Yielding Ground, W. W. Brush. *Water Works Eng.*, vol. 90, no. 9, Apr. 28, 1937, pp. 512–514. Construction of reinforced concrete mattress foundation to prevent settlement and breaks in five 48-in. mains at Manhattan Ave. and West 109th St., New York City.

MAINTENANCE AND REPAIR. Service Maintenance Truck with Air Compressor, H. S. Morse. *Eng. News-Rec.*, vol. 119, no. 9, Aug. 26, 1937, p. 362. Features of new service maintenance truck of Indianapolis Water Co., designed to carry all equipment necessary for crew which specializes in maintenance and replacement of customer services from main to property line.

SUBSIDENCE. Ground Subsides on 2-Mile Line. *Eng. News-Rec.*, vol. 119, no. 4, July 22, 1937, p. 136. Observations on ground surface subsidence along 2-mile length of Colorado River aqueduct distribution system, some 35 miles east of Los Angeles, during 3 1/2-year period ascribed to compaction of soil strata when water table lowers 100 ft.

WATER RESOURCES

FORECASTING. Forecasting Mountain Water Supply by Photographing Snowfall, D. D. Gross.

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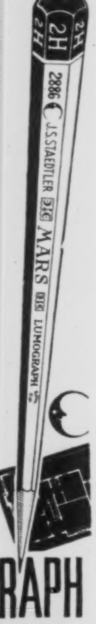

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Eng. News-Rec., vol. 119, no. 8, Aug. 19, 1937, pp. 310–311. Outline of practice developed at Board of Water Commissioners, Denver, Colo.; pictures of snow distribution are taken at regular intervals and correlated with runoff data from watershed; snowdrifts in gulches; variations in runoff.

RIO GRANDE. Flow of Rio Grande and Tributary Contributions. *U. S. and Mexico Int. Boundary Commission—Water Bul.*, no. 6, 1936, 103 pp. Recapitulated flow records and normals, 1924–1936; stored water in large reservoirs of Rio Grande Basin; runoff per square mile and relations to rainfall; silt, chemical constituents, bacteria, and dissolved oxygen; Rio Grande salt burden; floods at San Marcial and El Paso since 1828; rates of flood crest travel below Fort Quitman; evaporation and rainfall.

UNITED STATES. Progress in Federal Conservation of Water Resources 1936–1937, A. Wolman. *Am. Water Works Assn.—J.*, vol. 29, no. 7, July 1937, pp. 915–941. Review of United States federal operations in use and control of water resources; basic hydrologic data and research; development of national water policy; coordinated water planning; construction.

WATER TREATMENT

DRINKING WATER, FLUORINE CONTENT. Fluorides in Illinois Water Supplies, J. G. Weart and C. W. Klassen. *Am. Water Works Assn.—J.*, vol. 29, no. 7, July 1937, pp. 985–996, (discussion) 996–998. Tabulation and discussion of analytical and geological data on fluorine-bearing public water supplies in Illinois. Bibliography.

FILTRATION. Experiences in Filtration, J. R. Baylis. *Am. Water Works Assn.—J.*, vol. 29, no. 7, July 1937, pp. 1010–1048. Experience in rapid filtration and recent studies relating to filtration of water; filter operation in 1915; improvements in water purification; filter bed troubles; measuring volume of mud balls; effective size of filtering materials; determining effective size of sand in filters in service; effect of shape of filtering material; relation of sand size to length of filter run; process of filtration; rate of filtration. Bibliography.

FILTRATION, MATERIALS. Magnetite Filter in Sewage and Water Treatment, S. I. Zack. *Water Works & Sewage*, vol. 84, no. 6, June 1937, pp. 201–205. History of development; recent magnetite filter installations; upflow units; downflow units of important size; results accomplished by magnetite filters; cost of magnetite filters for sewage treatment. Before Am. Water Works Assn.

OZONE. Ozonising Plant at Knott Hill Reservoir, Ashton-Underlyne. *Engineering*, vol. 143, no. 3724, May 28, 1937, pp. 605–607; see also *Engineer*, vol. 163, no. 4247, June 4, 1937, p. 648. It is claimed that plant constitutes inexpensive way of remedying defect in existing water supply by making it possible to continue to use 64,000,000-gal reservoir; covered reservoir of reinforced concrete with capacity of 350,000 gal has been constructed; ozonization process selected was that of British "Otto" Ozone Water, London.

PLANTS, COVINGTON, KY. Filtered Water for Covington, J. S. Watkins. *Eng. News-Rec.*, vol. 119, no. 12, Sept. 16, 1937, pp. 466–470. Design and operation of 20-mgd water-purification system of Covington, Ky., in which Ohio River supply will be treated in new plant employing top and bottom filter wash, lime-soda softening, and automatic chlorination; filter wash system details; filter pipe gallery providing 7$^1/_2$ ft of headroom and 8 ft of clear width; piping and valves; architectural features; project costs $810,000.

PLANTS, NORTHBOROUGH, MASS. Northborough Filter Plant Designed with View to Treating Highly Colored Water, R. S. Weston. *Water Works Eng.*, vol. 90, no. 7, Mar. 31, 1937, pp. 388–391. History and description of water-filtration plant of Northborough, Mass., serving population of about 2,000; automatic control of filtration; operating results; removal of odor and turbidity and reduction of color; occurrence of mosquito larvae; construction cost. Before New England Water Works Assn.

PLANTS, ST. PETERSBURG, FLA. Water Treatment in Steel Tanks, M. Pirnie. *Eng. News-Rec.*, vol. 119, no. 12, Sept. 16, 1937, pp. 461–465. Design features of novel water treatment plant at St. Petersburg, Fla., in which softening, coagulation, and filtration operations are housed in cluster of welded steel tanks; arrangement of lime softening, filtration, and mixer units; chemical storage and feed; operating results; cost, including laboratory building, roadways, etc., $134,000.

SAMPLERS. Tap Sterilizer for Water Sample Collection, C. Leipold. *Am. Water Works Assn.—J.*, vol. 29, no. 7, July 1937, pp. 999–1000. Device for sterilizing water taps by flaming.

WATER POLLUTION. Report of Special Commission on Investigation of Discharge of Sewage into Boston Harbor and Its Tributaries, December 1936. Massachusetts House Document 1600. Boston, Wright & Potter Printing Co, Legislative Printers, 1937. 332 pp., figs., diagrs., charts, tables, supp. sheets. Engineers' report on tidal currents in harbor and pollution of streams tributary to Boston Harbor; sanitary condition of Boston Harbor; extension of outfall sewers; experimental sewage treatment; financial analysis; geologist's report on sewer tunnel under Boston Harbor; comparison of tunnel routes.

WATER WORKS ENGINEERING

AUSTRALIA. Increasing Melbourne's Water Supply, A. E. Kelso. *Commonwealth Engr.*, vol. 24, no. 1, Aug. 1, 1936, pp. 5–12. Improvement of water supply system of Melbourne, Australia, by enlarging capacity of O'Shannassy Aqueduct from 60 mgd to 200 mgd, laying of new pipe lines 46 to 72 in. in diameter, etc.; methods of construction and financing; total cost, £180,000.

CONCRETE CONSTRUCTION. Boughton Service Reservoir and Overleigh Water Tower of Chester Waterworks Company. *Engineering*, vol. 143, no. 3727, June 18, 1937, pp. 691–692; see also *Engineer*, vol. 163, no. 4249, June 18, 1937, pp. 698–699. New L-shaped reinforced-concrete subsidence reservoir has capacity of 10,000,000 gal; depth of water is 10 ft 6 in. and capacity 1,250,000 gal; water tower is reinforced-concrete structure with diameter of 58 ft 6 in. at base and total height of 102 ft 6 in.

FINANCING. Seven Ways to Finance Water Supply Improvements, A. W. Consoer. *Eng. News-Rec.*, vol. 119, no. 3, July 15, 1937, p. 96. Brief discussion leading to conclusion that elimination of leakage, distribution system improvements, and increased volume of sales will produce savings to finance needed extensions.

MANAGEMENT. Improving Water Works Management, E. G. Plowman. *Eng. News-Rec.*, vol. 119, no. 8, Aug. 19, 1937, pp. 322–324. Outline of sound administrative practice in guiding personnel relations, purchasing, engineering, customer service, and plant operation; departmental organization; elements of efficiency; furthering improvements.

OPERATION. How Other Fellow Does It, N. N. Wolpert. *Water Works Eng.*, vol. 90, no. 8, Apr. 14, 1937, pp. 456–460. Repair methods and practices followed by Water Department of Worcester, Mass.; winter maintenance methods; protection of exposed main; hydrant settings; inspection of hydrants; meter testing; frequency of tests; emergency service; stock records; repair shop equipment.

SANITATION. Ground-Water Supplies. *U. S. Pub. Health Service—Supp.*, no. 124, 1937, 25 pp. 5 cents. Progress report of Committee on Ground Water Supplies, Conference of State Sanitary Engineers, 1936; recommended minimum sanitary standards for location, construction, and protection of ground-water supplies.

UNITED STATES. Southeastern and Ky.-Tenn. Sections Hold Joint Meeting. *Water Works & Sewerage*, vol. 84, no. 5, May 1937, pp. 157–166. Proceeding including abstracts of papers and discussions: Water Supply System of Los Angeles, Hurlbut; Public Safety in Water Works Operation, T. W. Coleman; Some Problems Confronting Water Works Officials in Control of Water-Borne Disease, F. W. Kittrell; Sanitary Protection of Public Water Supplies, A. E. Griffin; Chemical Character of Natural Waters, W. L. Lamar; Birmingham Industrial Water Supply, A. C. Decker; Removal of Organic Detritus by Absorbent Clays, E. M. Slocum; Comparison of Filter Bed Materials, H. G. Turner and H. W. Schumpert; Licensing of Water Works Operators, W. W. Brush; Experiences in Emergency Operation of Louisville System During Flood, B. E. Payne; What Paducah Suffered, L. Sutherland; Bleaching Clay in Coagulation, Weir.

WATER LAW. Future of Water Allocation and Developments in Interstate Agreements, D. E. Minard. *Am. Water Works Assn.—J.*, vol. 29, no. 7, July 1937, pp. 942–950, (discussion) 950–959. Water rights; public and private rights; interstate streams; Supreme Court decision; voluntary agreements; political factors; state and federal agencies.

WATER SUPPLY, SUBAQUEOUS. Der Bau des Unterwassertunnels fuer die Kuehlwasserversorgung des Elektrizitaetswerkes in Dublin, E. Schnitter. *Schweizerische Bauzeitung*, vol. 109, nos. 5, 6, and 8, Jan. 30, 1937, pp. 49–51; Feb 6, pp. 65–67; and Feb. 20, pp. 88–90; see also French abstract in *Génie Civil*, vol. 110, no. 2863, June 26, 1937, pp. 574–575. Pneumatic caisson method of construction of subaqueous twin tube tunnel, 183 m long, for cooling water supply of electric plant at Dublin, Ireland; tubes are of circular cross-section, 1.85 m internal diameter.

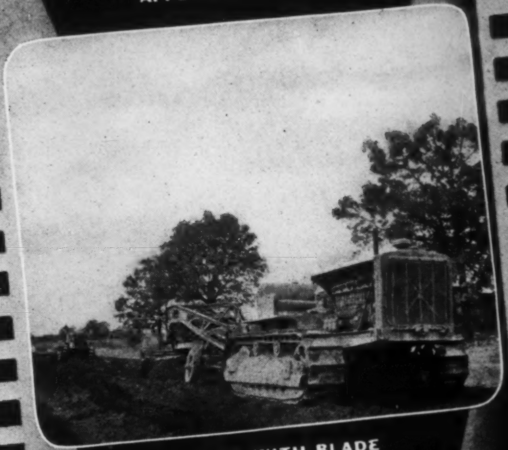
SOIL STABILIZATION...THE MOST WIDELY DISCUSSED SUBJECT IN ROAD CONSTRUCTION

ORIGINAL SURFACE AFTER LIGHT RAIN

APPLYING TARMAC

ROLLING

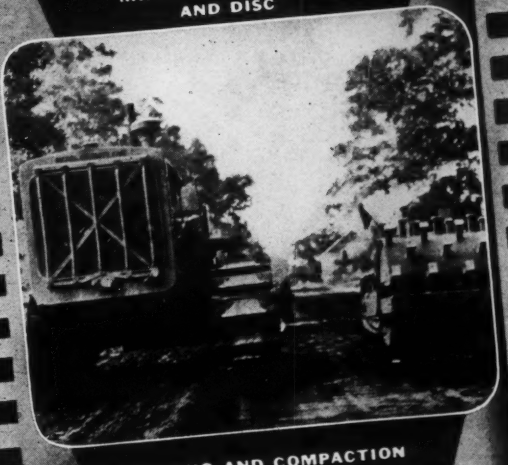
SCARIFYING



MIXING WITH BLADE AND DISC

TACK COAT OF TARMAC

ADDING WATER



SHAPING AND COMPACTION

SPREADING SAND OVER TACK COAT

DISCING

SHAVING OFF SURFACE OF STABILIZED ROAD

FINISHED ROAD THE FOLLOWING YEAR

The need for stabilizing soils without the addition of large quantities of aggregate is widely recognized.

Soil compacted at its optimum moisture content for maximum density will support traffic without being displaced. However, as it is impractical to keep soil at its optimum moisture content, some method of stabilization is needed. Tar has proved to be particularly suitable for this purpose. Soils containing as high as 70% of 200-mesh material have been successfully stabilized with Tarmac. The photographs here show a step by step procedure in stabilizing a road containing approximately 35% silt and 22% clay. Send for additional information about soil stabilization.

Tarmac

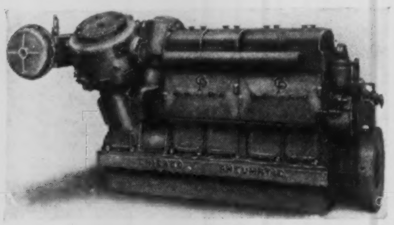
OPPERS COMPANY DESIGNERS • BUILDERS • MANUFACTURERS
PRODUCERS • DISTRIBUTORS • OPERATORS

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

Diesel Driven Compressors

THE NEW DESIGNS of the Chicago Pneumatic Tool Company's portable and stationary Diesel engine-driven compressors are announced and described in Bulletin 762, recently issued.



The portable type, Class WO-2, has an actual air capacity of 700 cu ft per min. It consists of the C-P Type 48 vertical, four-cylinder, four-cycle, medium-speed Diesel engine on common crankshaft with a "V" type two-stage, double-acting, water-cooled compressor, with suitable cooling systems and air receiver, all on a structural steel deck. Mounted on wheels or skids it is a complete, self contained portable unit.

The Class W-CO stationary unit uses the same engine and compressor as the portable, but is arranged for mounting on a permanent foundation or skids. It is built in sizes having three or four engine cylinders, rated 112$^1/_2$ and 150 hp, and with two-stage compressor cylinders having piston displacements of 655 and 830 cu ft per min, for a discharge pressure of 100 lb per sq in.

A copy of the bulletin may be obtained from the manufacturer's main office, 6 E. 44th St., New York, N.Y.

Road Maintainer

A NEW TYPE of machine for road maintenance, developed by the Allen Road Machinery Corp., Shreveport, La., has been in use for the past eighteen months. It is a double blade scraper for hauling behind truck or tractor, and is reported to be capable of operation up to a speed of 20 miles per hour. The manufacturer recommends it for any bladeable road—dirt, gravel, crushed stone, etc.

The feature of the machine is the automatic adjustment of the blade setting, controlled by the draw bar pull. This control regulates the quantity of material carried in the blades but does not, according to report, change the contour or crown set of the blades.

The Allen Road Maintainer is built in two sizes: 7 ft 6 in. wide, weighing 2,100 lbs, to be drawn by a 1$^1/_2$ ton truck; and 10 ft 6 in. wide, weight 3,500 lbs, requiring a 3 to 5 ton truck for operation.

New Le Tourneau Buggy

A NEW 15-yd, pneumatic-tired buggy, designed for rock jobs, long hauls, or work on levees where digging must be done by dragline or shovel, is announced by R. G. Le Tourneau, Inc., of Peoria, Ill., and Stockton, Calif.

This new buggy, except for capacity, is very similar to the Le Tourneau 24- and 30-yd buggies. It uses the same positive dumping method as the larger buggies. In unloading, the body moves backwards over the bed, pushing the load through an ever-widening opening to the rear, so that the wheels do not travel over the unloaded material. Extended, this opening is 7 ft 10 in. by 9 ft 10 in.—large enough to unload boulders. Unloading takes less than a minute and can be accomplished standing still, or on the move so that the load may be spread. Four 18 × 24 pneumatic tires and Timken roller bearings make the Le Tourneau 15-yd buggy a hauling unit of very light draft, which maneuvers like a two-wheel cart.

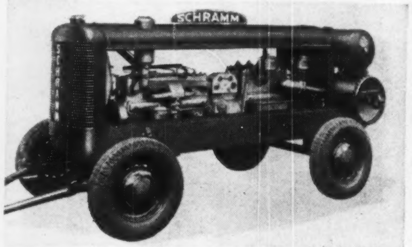
Like all Le Tourneau equipment, the 15-yd buggy is built out of alloy steel, arc welded throughout. The bottom is wood-filled and stoutly reinforced for handling the most punishing of loads. It has a struck measure capacity of 11.84 cu yds and a heaped measure capacity of 15 cu yds. Weight is approximately 14,500 lbs. It is built for use with "Caterpillar" RD7 and RD8 tractors, and is cable-controlled by Le Tourneau single drum power control unit or by a double drum power control unit when used in tandem.

Thread-Cutting Screws

THE DEVELOPMENT of a screw that cuts its own standard machine screw thread in metals and plastics of practically any thickness is announced by the Shakeproof Lock Washer Company. A patented thread-cutting slot, plus a special hardening process, eliminates the separate tapping operation normally required in the use of machine screws. An assortment of different sizes and complete instructions for testing can be had by writing the Shakeproof Lock Washer Co., 2501 North Keeler Ave., Chicago, Ill.

Schramm Compressors

A COMPLETE "Utility" Air Compressor line is offered by Schramm, Inc., in sizes 85, 105, 160, 210, 260, 315, and 420 cu ft actual air delivery, in both gasoline and Diesel engine driven models. Weight savings up to 3,500 lbs in the gasoline powered models and up to 8,000 lbs in Diesel powered machines have been effected.

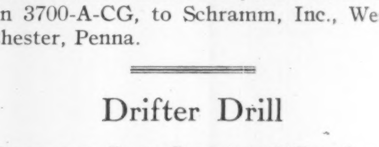


The straight-in-line cylinder construction is used on all models together with force-feed lubrication to all seven main bearings. Other features include electric self-starting on all models, self-aligning clutch between compressor unit and motor, mechanical intake valves, discharge valves occupying entire area of head, water cooled engine, and compressor and special attention given to modern, streamlined finish and all details of construction.

For further information, write for Bulletin 3700-A-CG, to Schramm, Inc., West Chester, Penna.

Drifter Drill

INGERSOLL-RAND COMPANY, 11 Broadway, New York, N.Y., has recently introduced a new drifter drill called the DA-30. It is in the 125-pound class, and is ideal for many mining operations such as small drifts, tunnels, and stopes. A new double-opening valve has greatly increased the drilling speed without increasing the air consumption. This new drill has proved to be equally as popular as its bigger brother, the DA-35 which was introduced in 1936.



The DA-30 with Auto-feed and Jackbits

Further details are shown in Form 2359, copies of which can be obtained by writing any of the Company's offices.

GETS CAPACITY LOADS •

• IN THIS MUCKY GOING

ALLIS-CHALMERS TRACTOR MODEL "L-O" AND GAR WOOD 10-YARD SCRAPER

conditions make no difference to this husky combination. With the ful Allis-Chalmers Model "L-O" Oil Tractor providing power, the Gar d Scraper "tears" through the toughest material . . . gets a capacity load in a shorter loading space—yet leaves the cut level and smooth, saving ng cost. Flexible front truck arrangement of Gar Wood Scraper per- nosing blade into cut for loading, and shortening wheel base for hauling akes possible easier maneuvering, shorter turning. Elimination of excess ht from both scraper and tractor means less power is required to move the t . . . more power goes to move pay-load. Tractor weight saved also s maximum performance in higher speeds—speeds at which 90 per cent ur tractor work is done. In addition, there is proper balance between d, power and weight—for better traction . . . superior performance on steep es . . . faster pick-up. The result is more trips per day—"Cheaper-per- d." See your nearest Allis-Chalmers dealer.

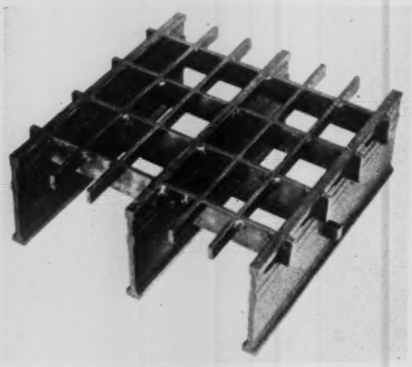
LLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE, U. S. A.

CONTROLLED IGNITION OIL TRACTORS

Bridge Flooring

A NEW, better bridge flooring—U.S.S. I-Beam-Lok Open Floor—is announced by the Carnegie-Illinois Steel Corporation, Pittsburgh, Pa.

This floor is very similar to the well-known U.S.S. I-Beam-Lok Floor. It consists of special, extra-depth 5 in. beams which form the elementary load-carrying members. These beams are spaced 6 in. centers, with carrying $1\frac{1}{4}$ in. × $\frac{1}{4}$ in. cross bars intersecting at 3 in. intervals—which in turn are notched at the top to receive two additional supplementary cross bars $\frac{3}{4}$ in. × $\frac{1}{4}$ in. spaced equally between the main carrying beams. The entire assembly produces a steel surface with rectangular openings approximately $1\frac{5}{8}$ in. × $2\frac{3}{4}$ in.



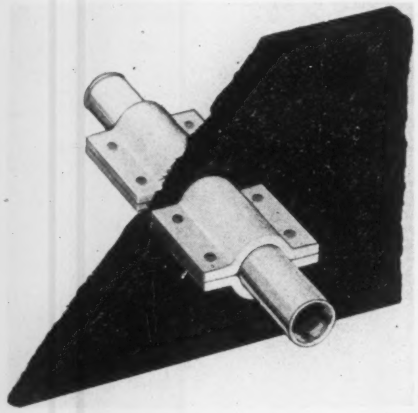
The new U.S.S. I-Beam-Lok Open Floor is reported to have many distinct advantages: It can be applied directly to stringers without supplementary supporting steel where the stringer spacing is not in excess of 4 ft or 4 ft 6 in. centers. Long life is assured by a construction with no sections less than $\frac{1}{4}$ in. thickness. This floor is light but strong, with a total weight above the stringers of 18.3 lbs per sq ft. Due to its light weight, it can be used to replace wood floors without sacrificing live load capacity of the bridge. Self-cleaning, rectangular openings have been so designed that there are no re-entrant angles, and no clogging with dirt, debris, snow or ice.

This floor is fabricated in standard widths up to 6 ft $1\frac{1}{2}$ in., lengths up to 49 ft, which reflects speedy handling and low erection costs. Units may be placed so that main carrying beams run either parallel or at right angles to traffic. The floor will prove to be of great advantage in vertical lift or bascule bridges on account of its light weight, and because wind resistance is reduced to a minimum.

"T-G Bar"

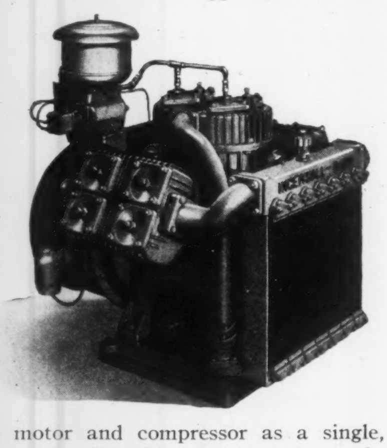
A RECENT CONTRIBUTION to road building is the "T-G Bar," a device designed and manufactured by the Five-Way Expansion Joint Company, Chicago, Illinois. The object of the device is to provide a dependable connecting support at the joint between the concrete slabs to eliminate vibration during load transfer, and at the same time permit free lateral slab movement during temperature changes.

The "T-G Bar" consists of a pair of stress reducers, a metal sleeve, a dowel and two caps for closing the ends of the sleeves and seal a lubricant therein. The stress reducers and the sleeves are made of special analysis steel stampings, heavily coated with zinc. This galvanized coating results in a permanent bonding of the concrete with the stress reducers and the sleeve. The dowel, a perfectly smooth, round, cold rolled bar, fits tightly within the sleeve. The dowel inside its metal sleeve never comes in contact with the concrete. A heavy coating of graphite grease on the dowel, together with the sealed reservoirs of grease at each end of the sleeve, assure the free movement of the dowel during expansion and contraction periods and in load transference, as well as protection from seep water over an indefinite period.



Motorcompressor

THE "MOTORCOMPRESSOR," described in Ingersoll-Rand's new Bulletin No. 3166, is a stationary, vertical, single-acting, two-stage, air compressor. The inter-cooler and the radially placed cylinders are air-cooled. As the name suggests, it combines the motor and compressor as a single, compact unit. The compressor crankshaft carries the motor rotor, and the compressor frame carries the motor stator. Flexible-coupling and V-belt drives are also available. Sizes range from 15 to 75 hp for discharge pressures from 80 to 125 lbs per sq in. Piston displacements range from 79 to 445 cu ft per min.



Copies of Bulletin No. 3166 may be obtained from Ingersoll-Rand, 11 Broadway, New York, N.Y.

Folders Announced

ALUMINUM PAINT—The Aluminum Company of America, Pittsburgh, Pa., has recently published an illustrated 104-page "Aluminum Paint Manual," covering such subjects as characteristics of aluminum paint, vehicles for aluminum paint, testing aluminum paints, methods of application and directions for the use of aluminum paint on various types of surfaces. The book also includes a chart showing finishes obtainable with Alcoa Albron Pigments.

CONCRETE MIXERS—Catalog No. 1582, covering Blaw-Knox Trukmixers, Agitators, and service to the ready-mixed concrete industry, will be sent to those interested upon request to Blaw-Knox Company, Pittsburgh, Pa.

EXPLOSIVES—The bulletin "Brands of du Pont Explosives and Uses to Which They Are Adapted" is the ninth edition of this chart, issued for the purpose of aiding users of explosives to avoid the use of unsuitable ones and to select those which will give the best results in proportion to cost, by E. I. du Pont de Nemours & Company, Inc., Wilmington, Del.

HARD-FACING—The Linde Air Products Co. (offices in principal cities) have prepared a folder, "Steel Hard-Facing Procedure," presenting detailed instructions for applying Haynes Stellite to steel wearing surfaces, with illustrations and sketches. The step-by-step procedure should enable any welding operator to hard-face steel with good results.

JOHNS-MANVILLE CATALOG—The 64-page, 1937–38 edition of the Johns-Manville Industrial Products Catalog is now available. Profusely illustrated, it contains information on insulations for every industrial need; specifications on Bonded Asbestos Built-Up Roofs and Insulated Roofs; corrugated Transite for roofing and siding; industrial friction materials; electrical materials; pressure pipe, vent pipe, and stacks; packing and gaskets; industrial flooring plank; asphalt tile flooring; Steeltex floor lath; welded wire reinforcement, etc. Form GI-6A, Johns-Manville, 22 East 40th St., New York, N.Y.

SCREWS—Dardelet Threadlock Corporation, 55 Liberty St., New York, N.Y., are publishing a series of eight or ten booklets dealing with definite groups of applications of their product. The second and latest booklet, No. 17, deals with the use of Dardelet Thread on Cap and Set Screws.

SNOW REMOVAL—Pertaining to snow removal problems and their economical solution, Caterpillar Tractor Co., Peoria, Ill., offers "Winter Warfare," a 15-page booklet showing photographs with explanatory captions of "Caterpillar" Diesel Tractors and Auto Patrols at work on winter maintenance jobs.

VENTURI METERS—Bulletin No. 293, giving many details of Venturi Meter Applications and treating specifically of the new Type M. Register-Indicator-Recorder and the Long Distance Chronoflo Meters, may be secured by writing to Builders Iron Foundry, Providence, R.I.

UP... UP... UP!

go the Demands on Wire Rope

Severest Requirements met by ROEBLING "BLUE CENTER"

To reduce operating costs to a minimum, it has been necessary in many instances to increase the capacity of wire rope rigged equipment. Speeds have been stepped up... loads boosted. As a result, wire rope has been called on to meet increasingly severe service.

For many applications where service conditions are severe, Roebling "Blue Center" Wire Rope has exactly met requirements. *It has proved conclusively that it assures lowest general average operating cost.*

If you are seeking a wire rope of superlative quality, one which will give you maximum safety and durability, at rock-bottom operating cost, investigate Roebling Blue Center... *the highest development in Roebling wire rope manufacture!*

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1 STRONGER Wire of highest strength consistent with ductility and toughness

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phia. Refers to M. B. Case, T. F. Comber, Jr., C. W. Hanson, F. M. Masters, J. T. Thompson.

Fay, Albert James, Jun., Cavite, Philippine Islands. (Elected Nov. 27, 1933.) (Age 32.) Lieut. (CEC), U. S. Navy; Asst. Public Works Officer, U. S. Navy Yard, being Design Supt. and Transportation Supt. Refers to A. D. Alexis, F. C. Bedell, L. B. Combs, T. R. Lawson, J. T. Mathews.

Golze, Alfred Rudolf, Jun., Bethesda, Md. (Elected March 28, 1932.) (Age 32.) Superv. Engr., CCC, Bureau of Reclamation. Refers to C. A. Hoglund, J. C. Page, G. O. Sanford, J. L. Savage, R. D. Welsh.

Hayes, Robert Dudley, Jun., Atlanta, Ga. (Elected Oct. 10, 1927.) (Age 33.) Sales Engr., Johns Manville Corporation. Refers to J. W. Barnett, R. P. Black, M. E. Cox, B. M. Hall, Jr., W. A. Hansell, R. G. Lose, D. H. Patton, C. A. Smith, F. C. Snow.

Hill, William Crawford, Jun., Brainerd, Minn. (Elected Oct. 24, 1932.) (Age 32.) Dist. Soils Engr., Minnesota Dept. of Highways. Refers to A. W. Bedell, G. C. Bickley, A. S. Cutler, H. M. Hill, T. W. Thomas.

Hollett, Arthur Russell, Jun., Chapel Hill, N.C. (Elected Oct. 1, 1928.) (Age 33.) Asst. Dean, School of Eng., Univ. of North Carolina, in charge of Dean's office; also Univ. and City Engr., Chapel Hill, Cons. Engr. and Consultant, Orange-Person Dist., Health Unit. Refers to H. G. Baity, T. F. Hickerson, G. D. Norcom, W. M. Piatt, R. M. Trimble.

Huie, Albert Van Arnam, Jun., Greenwich, Conn. (Elected Aug. 17, 1931.) (Age 32.) Engr., Madigan-Hyland, Cons. Engrs., New York City. Refers to R. W. Boyd, G. D. Clarke, G. L. Freeman, S. Hardesty, H. W. Hudson, E. Praeger.

Hunter, Archibald Daniel, Jun., Pearl Harbor, Hawaii. (Elected Nov. 23, 1931.) (Age 32.) Asst. Civ. Engr., U. S. Navy, Public Works Div., Navy Yard. Refers to R. E. Bakenhus, C. E. Beam, E. W. Bowden, L. W. Clark, C. H. Cotter, R. H. Mann, B. Moreell.

Morris, Robert Beverly, Jun., Washington, D.C. (Elected Jan. 13, 1936.) (Age 32.) Asst. Engr., PWA. Refers to A. H. Baker, S. A. Becker, R. J. Fogg, C. L. Mann, E. J. Newton, G. M. Rapp, H. Tucker.

Perkins, Henry Harvie, Jun., Washington, D.C. (Elected Dec. 14, 1925.) (Age 32.) Dist. and Cons. Adviser, Bureau of Air Commerce, U. S. Dept. of Commerce. Refers to F. N. Benedict, H. M. Bergman, H. A. Hook, A. H. Jorgensen, E. A. Prentis, F. C. Snow, W. H. J. Vollmer.

Pierce, Alton Louis, Jun., Beverly Hills, Calif. (Elected Oct. 29, 1934.) (Age 30.) Engr., Seaboard Eng. Co. Refers to G. W. Deibler, F. B. Kendall, R. M. Palmer, M. E. Phillips, S. B. Shepard.

Pope, Thomas Flint, Jun., Birmingham, Ala. (Elected Nov. 9, 1936.) (Age 33.) Structural Engr., Ingalls Iron Works Co. Refers to H. Cross, H. H. Jordan, W. A. Oliver, W. L. Sawyer, T. C. Shedd, C. A. Wilmore.

Purcell, William Stanley, Jun., New York City. (Elected Aug. 18, 1930.) (Age 33.) Senior Valuation Engr., Public Service Comm. Refers to C. S. Bilyeu, R. M. Guerry, J. Kappeyne, J. F. Krakauer, A. H. Pratt, P. A. Shaw, E. L. Walker.

Thorson, Edward William, Jun., Des Moines, Iowa. (Elected June 25, 1934.) (Age 32.) Dist. Structural Engr., Portland Cement Association. Refers to A. J. Boase, H. R. Green, M. L. Hutton, M. C. Miller, C. M. Stanley.

Vanderhout, William, Jun., Cleveland Heights, Ohio. (Elected Oct. 1, 1928.) (Age 32.) Engr. and Sales Engr., The Austin Co., Cleveland, Ohio. Refers to J. E. Ferguson, F. E. Foss, J. K. Gannett, E. W. Renz, A. J. Vernon.

Watson, John Dargan, Jun., Cambridge, Mass., (Elected Dec. 3, 1928.) (Age 32.) Asst. Prof. in Soil Mechanics, Graduate School of Eng., Harvard Univ. Refers to H. G. Baity, A. Casagrande, G. M. Fair, T. Saville, H. Sutherland, C. Terzaghi.

Wiedenhoefer, Edgar Paul, Jun., Houghton, Mich. (Elected Oct. 14, 1930.) (Age 32.) Asst. Prof. of Civ. Eng., Michigan Coll. of Mining and Technology. Refers to H. K. Barrows, G. C. Dillman, W. O. Hotchkiss, W. C. Polkinghorne, C. M. Spofford, H. Sutherland.

Woods, Robert James, Jr., Jun., Memphis, Tenn. (Elected Oct. 26, 1931.) (Age 31.) Sales Engr., Steel Constr. Dept., Jones & Laughlin Steel Corporation. Refers to E. F. Bespalow, W. C. Caye, Jr., H. N. Howe, F. V. Ragsdale, E. E. Schmied, W. C. Sensing, E. B. Wilkinson.

Young, Guy Raymond, Jun., Detroit, Mich. (Elected Aug. 17, 1936.) (Age 32.) Asst. Engr., Detroit Rock Salt Co. Refers to J. J. Dunkel, C. C. Johnston, J. L. Mann, C. J. J. Pajot, L. C. Wilcoxen.

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

Men Available

These items are from information furnished by the Engineering Societies Employment Service, with offices in Chicago, New York, and San Francisco. The Service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 87 of the 1937 Year Book of the Society. To expedite publication, notices should be sent direct to the Employment Service, 31 West 39th Street, New York, N.Y. Employers should address replies to the key number, care of the New York office, unless the word Chicago or San Francisco follows the key number, when it should be sent to the office designated.

Construction

Construction Engineer; Assoc. M. Am. Soc. C.E.; B.S. and C.E. degrees; 32; married; 11 years practical experience in irrigation, drainage, flood control, and railway construction, including structures; experienced in using heavy construction equipment; good executive; now employed; available on short notice; good references; desires permanent position with contracting or engineering firm. C-189.

Civil Engineer; Jun. Am. Soc. C.E.; 30; married. C.E. degree, Rensselaer Polytechnic Institute, 1930; 5 years general construction experience; New York state professional engineers license. Now in charge of WPA work in three counties. Desires job of permanent nature in construction or sanitary engineering. Will go anywhere. Available on two weeks notice. C-192.

Construction Engineer; Assoc. M. Am. Soc. C.E.; 20 years experience, railroads, industrial plants, river and harbor works, municipal construction; 7 years experience, urban and rural appraisals, flood damage surveys and appraisals, engineering valuation and reports; 4 years in Spanish-America. Will go anywhere. Available now. C-197.

Civil Engineer; Assoc. M. Am. Soc. C.E.; graduate; 33; licensed professional engineer, New York; 10 years building construction experience on public and private projects as engineer and construction superintendent in metropolitan and upstate New York. Completed expediting work on New York World's Fair construction. Available on short notice. C-198.

Engineer-Contractor; M. Am. Soc. C.E.; long experience in charge of work on highway construction, highway bridges, paving, railroad maintenance and construction, concrete construction, rock excavation, estimating and bidding jobs, cost keeping, and organization of work. Graduate of Cornell University. Desires connection in New York state outside New York City. C-199.

Structural-Architectural Engineer; Assoc. M. Am. Soc. C.E.; graduate civil engineer, University of Pennsylvania; registered engineer; 3-year evening course in accounting; 17 years varied experience, building construction; past 9 years with leading architect. Structural and architectural designing, detailing, approval of shop drawings, supervising construction, etc. Responsible charge. Excellent references. Location preferred—vicinity of Philadelphia or New York. C-200.

Construction Engineer; M. Am. Soc. C.E.; general superintendent; 25 years experience in building construction work; supervised some of finest and fastest work of this kind in this country. For 7 years average cost of work was 4 million dollars. Perfect health; abundance of energy; can produce results; will go anywhere. Available at once. C-203.

Civil Engineer; M. Am. Soc. C.E.; 10 years, location, design, and construction of highways; 4 years, railroad and bridge construction; 5 years, design and construction of sewer systems, water works, and school buildings; 1 year on heavy factory construction; 4 years hydraulic and flood-control work. Available immediately. C-204.

Design

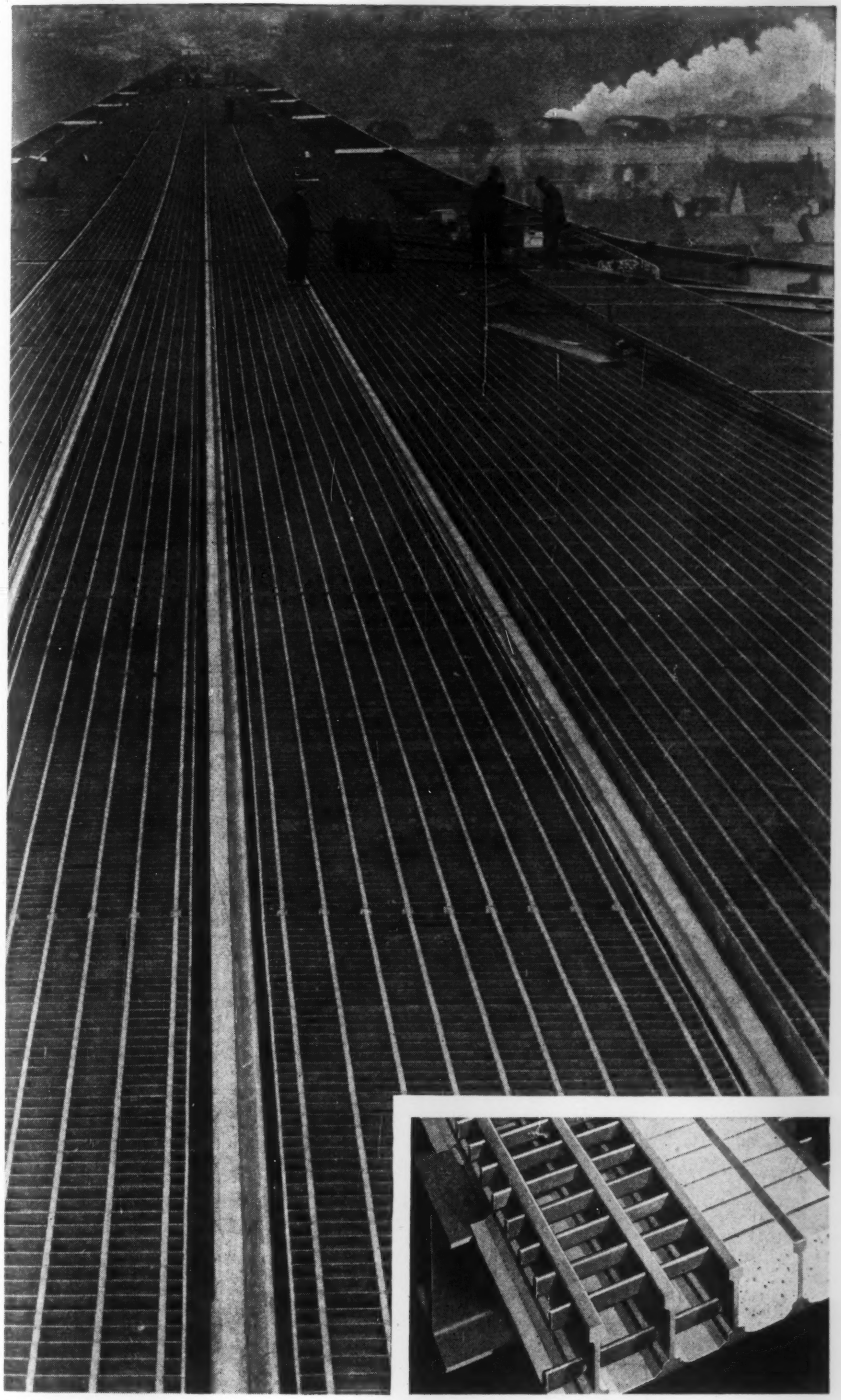
Civil Engineer; Assoc. M. Am. Soc. C.E.; graduate; registered in New York; age 38; married; 9 years experience, structural and concrete design of industrial buildings; 3 years experience, surveying and mapping. C-196.

Specification Writer, Designer; Jun. Am. Soc. C.E.; age 32; A.B. in C.E.; 4 years in responsible charge of water supply and structural design, including preparation of specifications; 3 years, building and pipe-line construction; 2 years, chief of survey party, highway and pole-line location. C-202.

Designing Engineer; M. Am. Soc. C.E.; over 35 years experience in design and construction of both steel and concrete bridges and kindred structures, having in the past 10 years designed and directed the construction of over $8,000,000 of bridges, viaducts, and grade-separation projects. Some $4,000,000 of continuous type. Now unemployed. C-205.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 48; licensed professional engineer, New York; 24 years varied experience, design, waterways, river and flood control, sanitary engineering, irrigation, drainage, soil improvement, highways, surveying, location survey—exclusively abroad. Desires position as designer or draftsman with

Floored with U·S·S I-BEAM-LOK



107,500 sq. ft. of armored concrete floor insures strength, long wear, minimum weight

THE $3,000,000 High Level Bridge spanning the Monongahela River at Homestead, Pa. adds another to the rapidly growing list of outstanding bridge structures floored with U·S·S I-Beam-Lok. 3200 feet long, it carries a four-lane, 40 ft. roadway and two 8 ft. cantilever sidewalks.

By using the new 4¼″ I-Beam-Lok floor slab units, weighing only 55.5 lbs. per sq. ft., slab strength to carry safely H-20 highway loading is assured. This substantial reduction in floor weight, incorporated into the original bridge design, makes possible material savings in total cost of the bridge structure.

Today, less than 3 years since its introduction, more than one million square feet of I-Beam-Lok floors have been used to floor 145 bridges, both large and small, new and old. May we tell you more about this truly modern bridge floor? Our engineers will gladly discuss its economies and application with you.

U·S·S ARMORED I-BEAM-LOK consists of a spaced series of small I-beams comprising the main structural elements, with the intervening spaces filled by concrete ribs. The beams and ribs are locked together into a rigid homogeneous slab by intersecting and interlocking steel top and bottom crossbars welded together at regular intervals. The upper edges of the top crossbars are brought into the plane of the roadway surface flush with the tops of the small I-beams, providing a steel armoring for the roadway. It is available in 3″ and 3½″ depths in units 4′ wide up to 50′ long and in 4¼″ depth 6′ wide and up to 49′ long.

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh *Chicago*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

firm of consultants or contractors to broaden American experience. Available immediately. Location anywhere. C-207.

Executive

Structural Engineer; Assoc. M. Am. Soc. C.E.; 47; married; excellent health; Pennsylvania license; rapid, competent designer; 25 years experience, design of mill, administration buildings, subways, railroad cars; construction of railroads and industrial plants; plant maintenance of steel mill; valuation of utility properties; machine shop experience; good working knowledge of Spanish. Will go anywhere. Now available. C-191.

Civil Engineer; Jun. Am. Soc. C.E.; 32; married; B.C.E., Ohio State University; 2 years, general construction; 3 years, railroad track maintenance; engineer reserve officer, active duty; 3½ years, CCC; 1 year, Corps of Engineers on flood control; 6 months research testing building materials, highway design, drafting. Available on reasonable notice. Location immaterial. C-194.

Graduate Civil Engineer; Assoc. M. Am. Soc. C.E.; 34; 11 years active practice, with experience in construction planning and supervision, estimating, cost control, and engineering office management. Interested in responsible position requiring initiative and ability. Available on reasonable notice. Location not material. C-187.

Junior

Civil Engineer; Jun. Am. Soc. C.E.; 26; B.S. C.E.; 1½ years, assistant engineer on design and construction of large swimming pool, sewers, concrete buildings, streets, and curbs; 2½ years, party chief on subways and tunnels, topographic and precise surveys; 1 year as topographic draftsman on works and maps; 5 years, study of Spanish. C-188.

Civil Engineer; Jun. Am. Soc. C.E.; 23; single; C.E., Cornell University, 1936. Experience—4 months survey work, 3 months steel design and estimating, and 1 year as second lieutenant, U. S. Army. Desires permanent position in design or construction, instructorship with research opportunities, or survey work. Location immaterial. Available two weeks notice. C-190.

Graduate Civil Engineer; Jun. Am. Soc. C.E.; 24; single; B.S.C.E., College of the City of New York; 1½ years drafting on city planning survey; 1 year, U. S. Engineer Office as inspector engaged in flood-control design on earth dams, channel improvements, levee systems. Desires opportunity in civil engineering. Location, New York City and environs. Available immediately. C-193.

Civil Engineer; Student Chapter Member; 22; single; B.C.E. and M.C.E., College of the City of New York, 1937; engineering honor fraternity. Assistant in materials testing laboratory; 8 months drafting experience with hydraulic manufacturing company. Desires opportunity any branch of civil engineering. Immediate salary secondary to opportunity. Location, preferably New York City or vicinity. Available immediately. C-195.

Concrete Engineer; Jun. Am. Soc. C.E.; 26; married; member American Concrete Institute; B.S.C.E.; Tau Beta Pi; 1½ years experience concrete inspection; 3½ years concrete testing, design, control, and research. Location immaterial. Desires position as concrete engineer, concrete technician, or assistant. C-201.

Civil Engineer; Jun. Am. Soc. C.E.; 23; single; B.S. in C.E., Rose Polytechnic Institute, 1936; 1½ years experience as engineer in railway maintenance department, both office and field work; desires position in construction or sanitary engineering; travel anywhere; available at once. C-206.

Civil Engineer; Jun. Am. Soc. C.E.; C.E. degree, Cornell University; 32; single; 2½ years transitman; 1½ years assistant engineer, W. P. A.; 2½ years, lieutenant CCC; free to travel; available immediately. Desires permanent connection. C-208.

Civil Engineer; Jun. Am. Soc. C.E.; 23; single; B.S. in C.E., Massachusetts Institute of Technology, 1934; 1 year drafting, simple designing of reinforced concrete in engineering department of park district; over 1 year field and office work with Corps of Engineers on dam, upper Mississippi River; employed but project completed; free to go anywhere. C-209.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. A comprehensive statement regarding the service which the Library makes available to members is to be found on page 77 of the Year Book for 1937. The notes regarding the books are taken from the books themselves and this Society is not responsible for them.

Business Administration for Engineers. By C. F. Harding and D. T. Canfield. New York and London, McGraw-Hill Book Co., 1937. 637 pp., diagrs., charts, tables, 9 × 6 in., cloth, $5.

Intended to assist the young engineer in correlating engineering with business, this book sets forth in the engineer's language, the organization, economic, and managerial problems of the industries and public utility corporations with which he is likely to be associated. Recent developments are illustrated by numerous tables and figures.

Delta, Estuary and Lower Portion of the Channel of the Colorado River 1933 to 1935. By G. Sykes. Washington, D.C., Carnegie Institution of Washington, 1937. 70 pp., illus., charts, maps, tables, 10 × 7 in., paper, $1.25.

This study of the lower Colorado River presents and interprets data on the flow, silt deposition, and movement of the river during the periods of time immediately preceding and following the closure of the Boulder Dam. The changing of the stream's habits in these respects is of importance geologically, economically, and sociologically.

Elasticity, Plasticity and Structure of Matter. By R. Houwink and W. G. Burgers. Cambridge, University Press; New York, The Macmillan Co., 1937. 376 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $6.

This is a comprehensive study of the elastic and plastic phenomena that accompany the deformation of matter. A great many classes of materials are included, and one object of the book is to compare and unify the results achieved in various fields, thus bringing the physicist, the chemist, and the technologist into closer contact.

Hydraulics, 4 ed. By R. L. Daugherty. New York and London, McGraw-Hill Book Co., 1937. 460 pp., illus., diagrs., charts, tables, 10 × 6 in., cloth, $3.50.

The new edition of this well-known text is considerably larger than its predecessor, 125 pages having been added. The presentation has also been generalized so as to apply to all fluids, thus affording a work on fluid mechanics applied to practical engineering. The text is based on the principles of dimensional analysis and the basic theorems of mechanics. The principal attention is devoted to broad fundamental principles.

Landwirtschaftlicher Wasserbau. (Handbibliothek für Bauingenieure, vol. 7, pt. 3, edit. by R. Otzen.) By G. Schroeder. Berlin, Julius Springer, 1937. 397 pp., illus., diagrs., charts, tables, 10 × 7 in., cloth, 36 rm.

Volume 7 of the hydraulics section of "Handbibliothek für Bauingenieure," covers agricultural hydraulics. The early chapters contain a brief treatment of fundamental soil and stream science, and such botanical and meteorological information as is necessary. The later chapters take up drainage through small and large water courses (including regulation), irrigation, and land reclamation.

Manual of Mathematics and Mechanics. By G. R. Clements and L. T. Wilson. New York and London, McGraw-Hill Book Co., 1937. 266 pp., diagrs., charts, tables, 9 × 6 in., leather, $3.75.

Facts and formulas useful in courses in mathematics and mechanics, also for general reference work, are given here. The numerical tables are mainly to four significant figures. Subjects covered include logarithms, trigonometrical functions, algebraic and geometrical formulas, hyperbolic functions, integrals, vectors, and properties of planes and solids.

Modern Management. By J. E. Walters. New York, John Wiley & Sons, 1937. 337 pp., diagrs., charts, tables, 9 × 6 in., cloth, $3.

A presentation of the methods of modern management and the application of the scientific method to the various phases of that management. Actual procedures are given in the various chapters, the titles of which correspond to the divisions of the definition of modern management: Methods, Money, Men, Materials, Manufacturing, Marketing, Measurement.

Standard Specifications for Public Works Construction. Edited by American Public Works Association (850 East 58 St.), Chicago, Ill., 1937. Tables, 9 × 6 in., paper, $3. ($4 with binder; special edition with binder, continuations, and revisions, $5.)

The present work is a revision of the specifications of the association, as revised to 1936. They cover the construction of various types of municipal improvements; subgrades and foundations for pavements; sidewalks, curbs, and brick, stone block and bituminous pavements. The specifications are intended as guides or models to assist the public-works engineer in preparing actual contract specifications.

(The) Story of Tunnels. By A. Black. New York, McGraw-Hill Book Co. (Whittlesey House), 1937. 245 pp., illus., 9 × 6 in., cloth, $2.75.

In this book the development of the art of tunnel-building is traced from the earliest times. The various methods of tunnel construction under different circumstances are described simply for the non-professional reader, mainly through descriptions of the construction of specific important tunnels.

Eidg. Materialprüfungsanstalt an der E.T.H. in Zürich, Laboratoire Fédéral d'Essai des Matériaux Annexé à l'École Polytechnique Fédérale à Zurich. Bericht No. 105. Die Unarmierten, Lotrecht Geschleuderten Stüssi-Zementrohe der Internationalen Siegwartbalken-Gesellschaft Luzern-Schweiz. December 1936, 24 pp. Bericht No. 106. Die Vianini-Rohre der Internationalen Siegwartbalken-Gesellschaft, Luzern-Schweiz. January 1937, 47 pp., illus., diagrs., charts, tables, 12 × 8 in., paper, apply.

Reports Nos. 105 and 106 are concerned with the cement pipes manufactured by the International Siegwart Beam Company, Lucerne, Switzerland. No. 105 covers the testing of materials and finished forms of unreinforced Portland cement pipes manufactured by the Stüssi vertical centrifugal process. No. 106 covers the manufacture, general properties, mechanical strength, chemical resistance, and hydraulic conductivity of reinforced concrete pipes produced by the Vianini process.

Vereinheitlichung der Materialtechnischen Erkenntnisse und des Sicherheitsgrades im Stahlbeton. By M. Ros. (Sonderdruck aus den "Monatsnachrichten" des Österreichischen Betonvereines: Gruppe Österreich, IV. Jg., Festschrift 1937.) Vienna, Oesterr. Druckund Verlagsgesellschaft, 1937. 19 pp., charts, diagrs., tables, 12 × 8 in., paper, apply to Technische Hochschule, Zürich, Switzerland.

This pamphlet discusses the possibility of establishing international standards for reinforced concrete. The fundamental principles are considered, the basic characteristics of concrete and steel are described, and the questions of permissible stresses and safety factors are investigated.

Before experimenting with any materials for underground mains—

CHECK THEM AGAINST THESE TEN POINTS OF PROTECTION

☐ ***Long Life:*** Has it long life? How long? In evaluating bids, cast iron pipe is universally figured at 100 years minimum.

☐ ***Internal Pressure:*** An average of many internal hydrostatic pressure tests on standard six-inch Class B cast iron pipe shows this pipe withstands more than 2100 pounds pressure per square inch. Another material failed at 290 pounds pressure per square inch.

☐ ***Tensile Strength:*** Routine specimens cut from standard Class B cast iron pipe show tensile strength ranging from 23,000 to 25,000 pounds per square inch. Another material shows a tensile strength of less than 2,000 pounds per square inch.

☐ ***Toughness:*** Under hydrostatic pressure and the impact of a 50 lb. hammer, ordinary cast iron pipe does not crack until the hammer is dropped four feet (beginning at one-foot with one-foot increases). Another material fails at one foot (beginning at three-inches with three-inch increases).

☐ ***Beam Load:*** Under beam stress tests, standard six-inch Class B cast iron pipe bears up under a load of 25,100 pounds and deflects approximately one-inch before breaking. Another material fails at 3760 pounds and deflects one-half inch.

☐ ***External Pressure:*** In regulation compression tests on a 12-inch section, standard six-inch Class B cast iron pipe withstands a crushing weight of 17,900 pounds. Another material fails at less than 4500 pounds.

☐ ***Imperviousness:*** The walls of cast iron pipe are impervious to leakage, seepage or sweating of water, gas or chemicals under internal hydrostatic pressure tests. Certain other materials are *not* impervious under similar tests.

☐ ***Tight Joints:*** For ordinary pressures, cast iron bell-and-spigot pipe—for high pressures, cast iron mechanical joint pipe—have stood the test of time and are known to be leak-proof. Certain other materials require joints yet to be proved.

☐ ***Tapping:*** Cast iron pipe taps cleanly with strong, tough threads, and loses little in structural strength. No other material withstands tapping as well.

☐ ***Flow Capacity:*** Under normal conditions, the flow capacity of cast iron pipe remains practically unimpaired for centuries. For the limited areas where active water is encountered, cement-lined or enamel-lined cast iron pipe is available. Under such conditions, no other material offers the combined long life and sustained flow capacity of lined cast iron pipe.

NOTE . . . *Check each point only if you know the material in question meets the requirements with adequate margin of safety. If in doubt, find out before installing.*

Some materials meet some and others meet others but only

CAST IRON PIPE

meets them all

The Cast Iron Pipe Research Ass'n, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Bldg., Chicago

CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Magazines in This Country and in Foreign Lands

Selected items from the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in the Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page, plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

Abutments, Settlement. Abutment Settlement Studied by Soil Mechanics, L. Grover. *Eng. News-Rec.*, vol. 119, no. 11, Sept. 9, 1937, p. 443. Results of field study of causes of settlement and tilting of one of abutments of new viaduct at Norton, Kans.

Pontoon. Concrete Pontoon Bridge Planned. *Eng. News-Rec.*, vol. 119, no. 10, Sept. 2, 1937, p. 373. Features of proposed highway bridge across Lake Washington between Seattle and Mercer Island, distance of 8,000 ft, which will consist of series of concrete pontoons, fastened together and anchored to sunken island at point where water is only 36 ft deep.

Railroad, Design. Bridge Design Data Charted, W. E. Belcher. *Eng. News-Rec.*, vol. 119, no. 4, July 22, 1937, p. 158. Graphical solutions for formula contained in 1935 specifications of American Railway Engineering Assn.

Steel, Welding. Part Welding and Cutting Played in Golden Gate Bridge, F. Crocker and E. L. Mathy. *Industry & Welding*, vol. 10, nos. 6 and 7, June 1937, pp. 15–16, and July, pp. 55–57. Welding procedure of Marin cofferdam utilizing steel scrap for bulkhead constructed on irregular foundation; excavation for San Francisco pier and welding applications; welded fender sections; particulars of welding on bridge deck.

Steel Truss, Tasmania. Design and Construction of Scamander Bridge, A. W. Knight. *Commonwealth Engr.*, vol. 24, no. 5, Dec. 1, 1936, pp. 157–162. Design and construction of 3-span steel-truss bridge, about 400 ft long, over Scamander River on east coast of Tasmania; cost data.

Suspension, San Francisco–Oakland Bay. Sketching Construction History of San Francisco–Oakland Bay Bridge, C. H. Purcell. *Western Construction News*, vol. 11, no. 11, Nov. 1936, pp. 353–354. Brief history of project and statistical summary of engineering data and costs. Bibliography.

Suspension, Vancouver. Proposed New Canadian Bridge. *Engineer*, vol. 163, no. 4244, May 14, 1937, p. 566. Particulars of design of bridge, to be known as Lions' Gate Bridge which will cross First Narrows, Vancouver; main portion is of stiffened suspension type, with central span of 1,550 ft, providing minimum clearance of 1,500 ft between inside faces of main piers.

Testing. Finding Weak Spots in Bridges, R. K. Bernhard. *Eng. News-Rec.*, vol. 119, no. 9, Aug. 26, 1937, pp. 353–356. Outline of continental European practice of applying induced vibration to bridges as means of locating defects, especially in welded structures, before and while they are in service; value of vibration tests; equipment used in testing; possibilities of resonance; natural frequencies, damping coefficient, and amplifying factor of railway and highway moving loads. Bibliography.

Viaducts, Concrete. Longest Concrete Viaduct on Washington Highway System Constructed at Rate of 200 Linear Ft per Week, L. V. Murrow. *Western Construction News*, vol. 11, no. 10, Oct. 1936, pp. 328–331. Construction of reinforced concrete viaduct, 3,994 ft long, on relocation project across Nisqually River bottom lands, completed in 189 working days; organization of construction forces and standardization of methods for maximum speed and economy.

Viaducts, Wooden. Grade Separation Viaduct Built of Treated Wood. *Ry. Age*, vol. 103, no. 8, Aug. 21, 1937, pp. 237–238. Creosoted wood used effectively in 5-span structure completed to carry North Dakota feeder highway over main line of Chicago, Milwaukee, St. Paul and Pacific, short distance across state line from Lemmon, S. Dak.; main span, 37 ft center to center of bents, was required to accommodate possible future second track at 14-ft centers in addition to existing track, this span being flanked on each side by intermediate span of 25 ft and end span of 19 ft 9 in.; structural details.

BUILDINGS

Air Conditioning Office Buildings, How Much Cooling. *Domestic Eng.*, vol. 149, no. 4. April 1937, pp. 73–76 and 181–183. Factors to be considered in estimating and installation of summer air conditioning in office building already constructed.

Building Codes, New York City. New York City Building Code, R. Fleming. *Engineering*, vol. 144, no. 3737, Aug. 27, 1937, pp. 235–238. Discussion and outstanding features of new code adopted by Board of Aldermen on July 20, 1937.

Soundproofing Walls. Transmission of Air-Borne Sound by Composite Partitions, C. J. Morreau. *Engineering*, vol. 144, no. 3735, Aug. 13, 1937, pp. 192. Working rules sufficiently accurate for most design purposes are formulated.

CITY AND REGIONAL PLANNING

Civic Centers. Civic Center in Oklahoma City, G. M. Orr. *Eng. News-Rec.*, vol. 119, no. 10, Sept. 2, 1937, p. 394. Description of recently completed civic center of Oklahoma City, Okla., in which new city and county government buildwere ings centralized in business section of city at cost of $7,700,000.

Maine. Maine State Planning Board Report, 1934–1935. State House, Augusta, Maine. 1936. 396 pp., figs., diagrs., charts, tables. First annual report discussing planning analysis; public works program; highways; public buildings and institutions; inland fish and game improvements; forests; railways; waterways; airways; land use and agriculture; conservation; wild life; recreational activities; electric light and power; public health; social conditions; industry and commerce; water resources; climatology, etc.

Slums. Yardstick for Slums, A. H. Fletcher. *Eng. News-Rec.*, vol. 119, no. 9, Aug. 26, 1937, pp. 341–343. Scoring system of slum classification developed by Memphis health department putting numerical value on housing conditions; tabulation sheet used by Memphis department of health in measuring conditions in slum areas of city; housing index correlations.

Traffic Surveys, Jackson, Mich. Report on City-Wide Traffic Survey and Proposed Improvements, Jackson, Mich., 1936–1937, Jensen, Bowen and Farrell, Ann Arbor, Mich., 1937. 118 pp., figs., diagrs., charts, tables. Population and traffic volume; analysis of accident records; accident-prone intersections; traffic routing; traffic signals; special studies; enforcement; parking; education; recommended ordinances.

Waterfront. Evansville Transforms Its Riverfront, L. A. Geupel. *Eng. News-Rec.*, vol. 119, no. 8, Aug. 19, 1937, pp. 307–310. Design and construction of broad boulevard, boat harbor and landing, park and promenade to reclaim unsightly and neglected waterfront area on Ohio River; new levee paved with stone; storm water conduit; damage from 1937 floods.

Water Supply. California's Long-Range Water Plan. *Eng. News-Rec.*, vol. 119, no. 9, Aug. 26, 1937, pp. 344–348. Construction features of Central Valley project, through which water stored on upper Sacramento is to be pumped up San Joaquin Valley, including two dams, power station, canals, and pumping stations; features of Kennett Dam 420 ft high; Contra Costa canal; Friant Dam 250 ft in height; Madeira canal and Friant-Kern canal; progress to date; acquiring water rights.

CONCRETE

Construction, Vacuum Compression. Concrete Treated by Vacuum Compression. *Construction Methods*, vol. 18, no. 11, Nov. 1936, p. 33. Description of process developed by Vacuum Concrete Corp., New York City, subjecting fresh concrete surfaces to vacuum suction removing excess water from concrete mix and bringing into action atmospheric pressure which compacts and consolidates concrete.

Cost Analysis. Graph for Cost of Concrete, E. W. DeBerard and N. Podolsky. *Eng. News-Rec.*, vol. 119, no. 9, Aug. 26, 1937, p. 362. Nomograph giving direct reading of concrete cost; numerical example.

Development. Concrete: Its Development and Applications, L. B. Mercer. *Commonwealth Engr.*, vol. 24, nos. 2 and 3, Sept. 1, 1936, pp. 35–42, and Oct. 1, pp. 95–98. September 1: Review of 30-year development in concrete materials and in design and control of concrete mixes. October 1: Distribution, placing, and curing.

Ready Mixed. Merchandising Designed Concrete, H. F. Thomson. *Eng. News-Rec.*, vol. 119, no. 8, Aug. 19, 1937, pp. 303–306. Manufacture and servicing of ready-mixed concrete; central mixing; truck mixing; possible length of haul; non-agitated delivery; delivery rate and volume; telephone information; trend towards improvement.

CONSTRUCTION INDUSTRY

Building Codes, Welding. New York's New Building Code Recognizes Structural Welding. *Welding Engr.*, vol. 22, no. 8, Aug. 1937, pp. 27–29. Provisions pertaining to welding are given.

Costs. Contract Unit Prices. *Eng. News-Rec.*, vol. 119, no. 4, July 22, 1937, p. 162, and (adv. sec.) p. 28. Unit costs bid on construction of Indiana state highways, concrete highway bridge in California, highway surfacing in Arizona, and sewage plant at Buffalo.

DAMS

Concrete Gravity. Grand Coulee Dam. *Oxy-Acetylene Tips*, vol. 16, no. 8, Aug. 1937, pp. 173–175, and 178–179. General description of dam under following headings: construction problems, cofferdams, gravel plant and conveyors, application of oxy-acetylene welding and welding in construction.

Concrete Gravity, Raising. Raising O'Shaughnessy Dam 85 Ft. *Western Construction News*, vol. 11, no. 12, Dec. 1936, pp. 377–381. Raising maximum height of San Francisco water supply dam from 345 to 430 ft above foundation; review of design problems and construction procedure; artificial cooling of added concrete to provide proper stress distribution in making completed structure act as unit; camp and facilities; aggregate preparation; batching and mixing plant; preparation of abutments.

Concrete Gravity, Washington. Grand Coulee Cofferdam Removal. *Eng. News-Rec.*, vol. 119, no. 10, Sept. 2, 1937, p. 401. Methods used in demolition of cofferdam for construction of Grand Coulee Dam; excavation totals; steel sheeting pulled by cranes and timber cribs uprooted by power shovels.

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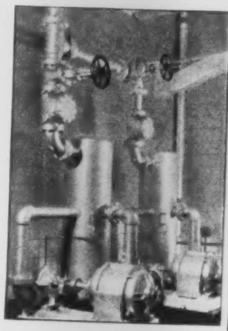

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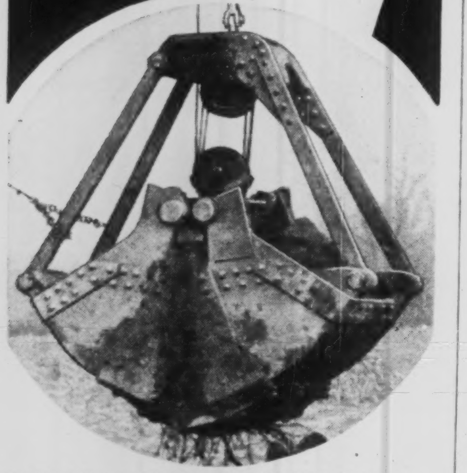

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EARTH, UTAH. Construction of Pine View Dam, Ogden River Project, G. C. Imrie. *Reclamation Era*, vol. 27, no. 8, Aug. 1937, pp. 180–183. Design and construction of earth and rock-fill dam over Ogden River, Utah, having maximum height of 102 ft and crest length of 500 ft; estimated cost $1,383,000.

LANDSLIDES, CONTROL. Freezing a Dam. *Power Plant Eng.*, vol. 41, no. 7, July 1937, pp. 433–434. Frozen arch dam constructed to stop landslides occurring during building of Grand Coulee Dam; two ammonia compressors used with combined capacity of 80 tons; details of construction of freezing points; methods used and results obtained.

ROCK FILL. Rate of Fill at San Gabriel Dam Exceeds 525,000 Cu Yd per Month. *Western Construction News*, vol. 11, no. 10, Oct. 1936, pp. 336–339. Construction of rock-fill dam San Gabriel No. 1, 375 ft average height above bedrock; quarry procedure; drilling and shooting; loading and hauling; handling rock fill; organization.

ROCK FILL, ALABAMA. Five Classes of Fill in Large Dam, J. D. Jacobs. *Eng. News-Rec.*, vol. 119, no. 9, Aug. 26, 1937, pp. 357–361. Description of Inland Dam in course of construction on Warrior River near Birmingham, Ala., to contain 1,000,000 yd of mechanically crushed and quarry rock and 600,000 cu yd of compacted earth fill; maximum height 195 ft; crest length 1,100 ft; shaft work; concreting methods; aggregate and mixing plant; open-cut excavation; quarry and crushing plant; clay fill.

ROCK FILL, CALIFORNIA. San Gabriel Dam Is Completed, H. V. Kaeppel. *Earth Mover*, vol. 24, no. 8, Aug. 1937, pp. 16–21. Quarrying and placing of some 11,000,000 cu yd of rock in construction of San Gabriel Dam No. 1, which is about 375 ft high.

RESERVOIRS, EVAPORATION. Evaporation Loss in Covered Reservoirs, A. A. Young. *Eng. News-Rec.*, vol. 119, no. 11, Sept. 9, 1937, pp. 432–434. Study of evaporation characteristics of covered reservoirs with limited ventilation indicating that little water is conserved through use of roof structures; during 11-month test period at 200,000-gal covered reservoir in La Verne, Calif., actual saving was found to be but 13.7 in. of water; comparison of evaporation from floating pan in covered reservoir and exposed land pan; factors affecting evaporation.

WEIRS, APRONS. General Theory of Gradient of Pressure Under Structure on Permeable Foundations, with Applications to Evaluation of Gradient at Exit for Some Standard Cases, J. K. Malhotra and E. McKenzie-Taylor. *Punjab Irrigation Research Inst.—Research Publ.*, vol 2., no. 16, Oct. 1936, 10 pp. Price Re. 0-3-0 or 4d. Mathematical theory of gradient of pressure developed from first principles. Bibliography.

FLOOD CONTROL

SANITARY PROBLEMS. Experiences at Louisville, Kentucky, During Ohio River Flood of 1937, E. S. Chase. *Boston Soc. Civ. Engrs.—J.*, vol. 24, no. 3, July 1937, pp. 272–288. Description of flood and conditions resulting therefrom; rainfall and river stage; organization of Emergency Division of Sanitary Engineering of Jefferson County Board of Health; sanitation of health and refugee centers; water supply sanitation; disposal of dead animals; spoiled and contaminated food; inspection of flooded homes; emergency organization for disasters.

WATER WORKS, DAMAGE. How Water Was Supplied During Flood in Areas near Louisville, E. S. Chase. *Water Works Eng.*, vol. 90, no. 6, Mar. 17, 1937, pp. 359–360. Operation of Louisville, Ky., water works during flood emergency of 1937; hospital served by damming stream; disinfection by hypochlorite plant; boiling water from wells.

FOUNDATIONS

PILES, CONCRETE. Drilled Piles Seated in Rock Sockets. *Eng. News-Rec.*, vol. 119, no. 11, Sept. 9, 1937, pp. 434–436. Increasing load capacity of special concrete-filled pipe piles for New York City municipal garage, by extending steel H-core and concrete several feet into bedrock, thus causing considerable portion of load to be delivered to bedrock not by direct bearing but by bond with rock.

SLOPES. Stability of Earth Slopes, D. W. Taylor. *Boston Soc. Civ. Engrs.—J.*, vol. 24, no. 3. July 1937, pp. 197–246. Comparative review of methods proposed for analyzing stability of earth slopes; simplifying assumptions; measurement of constants describing shearing strength of soil; values for unit weight; effect of seeping water; logarithmic spiral method; effects of saturation and seepage; surface cracking; illustrative examples. Bibliography.

SOILS, PHYSICS. Development of Soil Mechanics, F. L. D. Wooltorton. *Structural Engr.*, vol. 15, (new series) no. 8, Aug. 1937, pp. 327–330. Review of progress of soil mechanics; moisture content of soil; linear shrinkage; expansion pressure; shrinkage limit; clay complexes. Bibliography.

HYDRAULIC ENGINEERING

RESEARCH. Current Hydraulic Laboratory Research in United States. *U. S. Dept. Commerce—Nat. Bur. Standards—Hydraulic Laboratory Bul.*, V-2, July 1, 1937, 139 pp. Current projects in hydraulic laboratories of United States; hydraulic research in Canada and in France; hydraulic research committees.

IRRIGATION

INDIA. Development of Irrigation in India. *Engineer*, vol. 164, no. 4254, July 23, 1937, pp. 104–105. Statement showing return for irrigation works for which capital and revenue accounts are kept to end of 1934–1935; brief description of two largest projects recently completed, Lloyd (Sukkur) barrage and canal and Mettur Dam.

IRRIGATION CANALS, REGULATORS. Report on Experiments with Model of Khesano Regulator on Rohri Canal, Mile No. 194, carried out in Development and Research Division at Karachi Testing Station, W. E. Bushby and M. G. Hiranandani. *Sind. Pub. Works Dept.—Tech. Paper, No. 1*, 1937, 3 pp., 15 supp. plates. Price 4s 10½d. Results of model tests undertaken for purpose of correcting unusual turbulence below irrigation canal regulators.

LAND RECLAMATION AND DRAINAGE

NETHERLANDS. Die Trockenlegung der Zuiderzee, O. J. Herz. *Wasserwirtschaft u Technik*, vol. 4, nos. 5–6, Feb. 28, 1937, pp. 51–60. Description of lock systems in Zuiderzee reclamation project; development of Wieringermeer polder; cost data; removal of salts in Ysselsee; agricultural utilization of reclaimed area.

PORTS AND MARITIME STRUCTURES

BREAKWATERS, EARTH CORE. Earth Core Cheapens Rock Breakwater, M. W. Gilland. *Eng. News-Rec.*, vol. 119, no. 10, Sept. 2, 1937, pp. 398–400. Detached breakwater, 12,500 ft long, for Los Angeles and Long Beach outer harbors, consists of dredge-built fill covered with stone; average depth of water along axis of breakwater is 50 ft; materials and payments; equipment and methods; progress, quantities, and costs; economy of composite type.

CORROSION. Deterioration of Structures in Sea Water. *Surveyor*, vol. 91, no. 2354, Mar. 5, 1937, pp. 395–396. Tests of timber, metal, and concrete; investigation of committee of Institution of Civil Engineers.

PIERS. When Pier Settles, A. R. Ketterson. *Ry. Eng. & Maintenance*, vol. 33, no. 9, Sept. 1937, pp. 609–610. Measures that should be employed, when such contingency occurs, are described in detail.

ROADS AND STREETS

ACCIDENT PREVENTION. Road Accidents Prevention. *Surveyor*, vol. 91, no. 2355, Mar. 12, 1937, pp. 411–412. Means of accident prevention and control; location of vehicle stopping places; all-red period; warning of approach to pedestrian crossings; by-passing of traffic signals. Abstract of discussion before Instn. Mun. & County Engrs.

ACCIDENT PREVENTION, PLANNING. Road Planning with Special Reference to Safety, W. H. Budgett. *Surveyor*, vol. 91, no. 2354, Mar. 5, 1937, pp. 375–377. Analysis of accidents on British highways; introduction of dual roadways; standard widths and building control; traffic lines. Before Instn. Engrs. & Shipbldrs. in Scotland.

ASPHALT. Asphalts for Low-Cost Road Construction, J. E. Easterbrook and R. K. Stratford. *Can. Chem. & Met.*, vol. 21, no. 7, July 1937, pp. 253–254. Laboratory investigation for purpose of developing low-cost roads for lightly traveled highways, as connecting links between main highways, in Canada; methods of manufacture of asphalt; application to roads. Before Can. Chem. Convention.

BITUMINOUS. Recent Developments in Application of Bituman Road-Mix to Gravel Roads, E. W. C. Godfrey. *Commonwealth Engr.*, vol. 24, no. 3, Oct. 1, 1936, pp. 96–100. Review of experience gained by Main Roads Department of western Australia in construction of road-mix type of asphaltic surfacing; selection of gravel;

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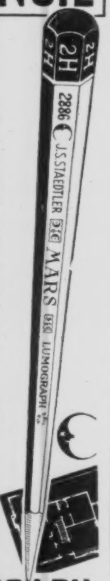

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CONSTRUCTION. Road Transport Resurrects a Railway. *Eng. News-Rec.*, vol. 119, no. 5, July 29, 1937, pp. 175–178. Utilization of old grade and tunnels of South Pennsylvania Railroad, partly completed half a century ago, for express highway 164 miles long leading from Harrisburg to Pittsburgh; estimated cost $60,000,000.

GUARD RAILS. On Guard to Deflect Vehicles. *Safety Eng.*, vol. 73, no. 1, Jan. 1937, pp. 9–10. Importance of having more and better guard rails on highways in order to promote greater safety; brief consideration of purposes and requisites of guard rail.

HIGHWAY ADMINISTRATION, FINANCING. Financing City Pavements. *Am. City*, vol. 52, no. 8, Aug. 1937, pp. 83, 85, 87, and 89. Data on methods of financing paving of streets in cities in every state of the United States.

HIGHWAY SYSTEMS, FLORIDA. Overseas Road to Key West, H. Chamberlin. *Eng. News-Rec.*, vol. 119, no. 10, Sept. 2, 1937, pp. 388–391. Construction for conversion of 33 miles of former roadbed and bridges of Florida East Coast Railway into paved roadway of standard width for automobiles; bridge renovation; paving details.

LOW COST. Cemented Telford Pavement, M. H. Small. *Eng. News-Rec.*, vol. 119, no. 7, Aug. 12, 1937, p. 262. Description of cheap street paving accomplished at Neosho, Mo., by laying field stone as Telford and binding and surfacing it with chats concrete.

MATERIALS, BITUMINOUS. Mechanical Properties of Bituminous Surfacing Materials Under Constant Stress, A. R. Lee and A. H. D. Markwick. *Soc. Chem. Industry—J. (Trans. & Communications)*, vol. 56, May 1937, pp. 146T–156T. Attention concentrated on determining and explaning behavior of materials under simplest possible conditions of stress; immediate problems to be solved are effects of viscosity of binder, aggregate grading, and applied stress on resistance to deformation; tests described believed to afford best means of investigating these problems.

MOTOR TRANSPORTATION. Effect of Highway Design on Vehicle Speed and Fuel Consumption Studied in Oregon, J. Beakey. *Pub. Roads*, vol. 18, no. 6, Aug. 1937, pp. 117–118. Abstract of Oregon State Highway Commission Bulletin reporting experiments performed to measure effect of highway design on vehicle speed and fuel consumption; effect of grades on fuel requirements; road design; Diesel-powered trucks.

RAILROAD CROSSINGS, SIGNALS. Crossing Protection on Monon. *Ry. Signaling*, vol. 30, no. 7, July 1937, pp. 397–399. Flashing light signals with rotating stop signs and special cut-outs for switching operations, installed at crossing of Second Street in Bloomington, Ind., as part of program of crossing protection of State of Indiana; flashing light units are of W. R. S. Co. no. 880–1 type; crossing bell is mounted on signal east of track; diagram of circuits is given which shows automatic cut-outs.

STABILIZATION. Developments in Road Stabilization, A. R. Brickler. *Purdue Univ. Eng. Bul.—Extension Series*, no. 38, vol. 21, no. 2, Mar. 1937, 49 pp. Purpose of stabilization: clay-aggregate stabilization; bituminous stabilization; cement stabilization. Bibliography. Before 23d Annual Purdue Road School, Jan, 25–29, 1937.

STABILIZATION, KANSAS. Road Soil Base, Bound with Cement, H. Allen. *Eng. News-Rec.*, vol. 119, no. 11, Sept. 9, 1937, pp. 437–439. Experience of Kansas State Highway Dept. with field methods and equipment used in stabilizing silty soil with cement; practical observations on improvements needed.

SEWERAGE AND SEWAGE DISPOSAL

PAPER AND PULP MILLS. Treatment of Industrial Effluent. *Power & Works Engr.*, vol. 32, no. 376, July 1937, pp. 263–267. Description and layout of plant installed at Croxley paper mills of John Dickinson and Company; effluent divided into sections, one of which acts as neutralizing agent; treatment of effluent and necessary equipment described during flow process; filtration and compressed air services.

PLANTS, GLASS COVERS. Glass Covers for Sewage Works—Design and Maintenance, W. Kelsey. *Am. City*, vol. 52, no. 8, Aug. 1937, pp. 51–52. Brief review of American practice of design and maintenance of glass covers used as enclosures for sludge beds, sprinkling filters, rotary distributors, settling and skimming tanks; replacing glass; painting.

PLANTS, LOS ANGELES. Sewage Plant Features Sludge and Gas Handling, G. A. Parkes. *Western Construction News*, vol. 11, no. 11, Nov. 1936, pp. 355–357. Description of Terminal Island sewage-treatment plant of city of Los Angeles using concentration tanks to supplement single-stage digestion; control and safety in use of gas; major plant equipment.

WISCONSIN. Wisconsin Sanitation Advances. *Eng. News-Rec.*, vol. 119, no. 9, Aug. 26, 1937, p. 361. Sewage disposal and water-supply improvements in Wisconsin communities furthered by federal funds during last 3 years.

STRUCTURAL ENGINEERING

EXHIBITION BUILDINGS, DESIGN. Concrete Walls as Counterweights. *Eng. News-Rec.*, vol. 119, no. 12, Sept. 16, 1937, pp. 478–480. Structural features of two San Francisco exposition buildings, designed for later use as hangers; arch dead loads are counterbalanced by hanging walls from steelwork; 3-hinged arches carry each concrete side wall as cantilevered load hung in vertical plane outside arch pipe lines; pylons at either end of side walls are also suspended from structural frame; wall construction.

ROOFS, WELDED STEEL. Welding Beats Wind, Rain, Snow, Heat, and Cold, H. E. Foote and J. B. Olmstead. *Industry & Welding*, vol. 10, no. 9, September 1937, pp. 21–24. Details of construction employed and welding procedure in placing steel roof covering area of 750,000 sq ft; insulation and roof finishing shown; problems encountered in using welding machines.

TUNNELS

CONSTRUCTION, BLASTING. Use of Safety Primers in Tunneling, R. E. Munn. *Eng. News-Rec.*, vol. 119, no. 4, July 22, 1937, pp. 158–159. Features of safety primers extensively used in Colorado aqueduct tunneling.

VEHICULAR, CONCRETE LINING. Lining Lincoln Tunnel. *Eng. News-Rec.*, vol. 119, no. 9, Aug. 26, 1937, pp. 349–353. Placing of interior concrete shell of new vehicular tunnel at New York complicated by deep pockets in iron lining, thin coverage over ribs, and numerous service facilities to be buried in concrete; placement of ceiling slab by pumping.

VEHICULAR, GREAT BRITAIN. Mersey Tunnel Cleansing Methods, R. J. Watson. *Surveyor*, vol. 91, no. 2355, Mar. 12, 1937, p. 413. Mechanical equipment for removal of oil and grease deposits; deposits from exhaust gases; cleansing of gullies, air ducts, etc.

WATER WORKS ENGINEERING

GREAT BRITAIN. Haweswater Waterworks *Engineer*, vol. 163, no. 4243, May 7, 1937, pp. 534 and 538. Brief description of new water works including dam at north end of Haweswater and aqueduct, including tunnel 5 miles long.

GREAT BRITAIN, HISTORY. Portsmouth Water Supply. *Water & Water Eng.*, vol. 39, no. 481, July 1937, pp. 401–406. History and description of pumping stations, filtration plant, etc., of water works serving population of about 300,000.

INTAKES. Waterworks Intakes of Great Lakes, B. Hudgins. *Geographical Rev.*, vol. 27, no. 3, July 1937, pp. 457–466. Difficulties of construction and maintenance of water works intakes on Great Lakes of North America; physical character of Great Lakes; location of intakes; winds, currents, and floods; ice conditions; slope and material of lake bottom; lake traffic.

MANAGEMENT. Effective Waterworks Organization—II, E. G. Plowman. *Eng. News-Rec.*, vol. 119, no. 7, Aug. 12, 1937, pp. 269–270. Abandonment of apron-string relationship between regulatory branch of city government and water utility; organization weaknesses; independent water boards; features of well-managed utilities.

MANAGEMENT, SURVEY. What's Wrong in Waterworks Management—I, E. G. Plowman. *Eng. News-Rec.*, vol. 119, no. 6, Aug. 5, 1937, pp. 225–226. Results of field survey of water-works management in more than 40 American cities; weaknesses in municipal water utility management attributed to complete charter restrictions, departmental over-functionalization, and influence brought by perversive public opinion.

WELLS. Wells of Gravel-Wall Type Offer Distinct Advantages Where Underground Water Is Present in Sand or Gravel, C. M. Willis. *Oil Weekly*, vol. 85, no. 7, Apr. 26, 1937, pp. 46 and 48. Description and sketches of suitable type of well for supplying water for oil field use; hand digging and machine-drilling methods; practice of Panhandle Eastern Pipe Line Company in Kansas and Texas, in construction of several wells of different diameters and depths.

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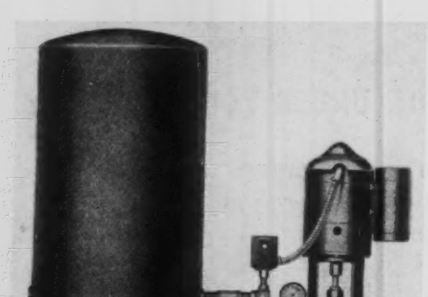
A NEW VERTICAL, close-coupled motor-driven centrifugal pump for general service in deep or shallow wells has been announced by Fairbanks, Morse & Co. This new pump was designed to meet the need for a small-diameter, compact, dependable pump with low initial and operating costs for economically pumping water under either high or low pressure at 6 to 60 gallons per minute. Simple in design, quiet and dependable in operation, the pump requires no lubrication and only a minimum of attention. There are no mechanical moving parts below the ground—no gears, belts, pulleys, rod springs nor valves to be replaced or repaired.



Units for shallow well service consist of combined motor, pump and base, into the bottom of which is screwed a single suction pipe extending below the water level. This is satisfactory for water lifts of 15 to 20 ft.

Pumps for deep wells—20 to 200 ft deep—are equipped with an ejector and venturi in one of two drop pipes extending from the pump down into the well. This deep-well pump operates on the accepted principle of the centrifugal pump, with the ejector added to lift water from depths beyond that from which a centrifugal pump alone will lift it. Positive water lift is insured

The construction and application of the F-M Fig. 6640 vertical centrifugal pump is described in Bulletin 6640, available upon request from Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill.

New Crane Valves

NEW LINES of brass screwed end globe, check and gate valves for 350 lbs steam pressure at 550 degrees temperature are being offered by Crane Co., Chicago. These valves are designed especially for high pressure steam lines such as are used on oil and gas field boilers for deep well drilling operations. They also may be used on non-shock cold water, oil, or gas lines up to 1,000 lbs. Their sizes range from $^1/_2$ in. to 2 in.

The globe pattern brass valve (62-P) is of the union bonnet design (except the 2 in. which has a bolted bonnet) and has Crane nickel alloy plug type disk and Exelloy body seat ring. The stuffing box is supplied with a gland and is filled with high-grade packing which may be replenished when the valve is wide open and under pressure.

The horizontal lift check valve also has a union bonnet except the 2 in., which has a bolted cap. Disks are of the piston guided type and seats are renewable screwed in rings of Crane nickel alloy. The horizontal swing check valve (No. 78-E), which may be used either for horizontal or upward flow, has screwed cap and tapped hole in the body to facilitate regrinding of the disk.

For severe service on small lines carrying steam, hot water, cold water, oil, gas, and similar fluids, Crane Co. is offering a line of brass globe (No. 14$^1/_2$-P) and angle (No. 16$^1/_2$-P) valves with plug type disk of Crane nickel alloy and body seat ring made of Exelloy. Made in sizes $^1/_8$ to 3 in., those valves are recommended for 150 lbs steam working pressure and 300 lbs on cold water, oil, or gas lines. Their wide seat bearing is unusually resistant to wire drawing and foreign matter, and their tapered disk permits easy flow regulation when throttling.

Iron body globe and angle valves, in sizes from $^1/_4$ to 3 in., for 150 lb steam working pressure and 300 lb on water, oil, or gas lines, are also announced.

Field Brinell Tests

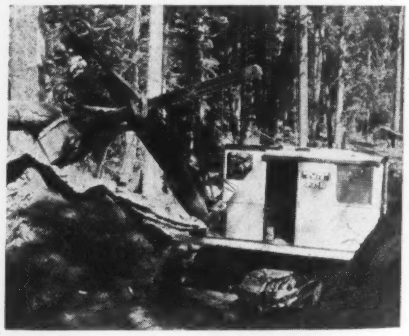
A LIGHT WEIGHT, portable Brinell instrument, which is reported to simplify metal hardness tests in the field, recently has been developed.

The instrument, known as the Telebrineller, with all accessories and its carrying case weighs only 6$^1/_2$ lbs. The complete outfit is composed of the Telebrineller instrument, a bar of known hardness, a microscope with a scale etched in its focal plane and a slide rule, packed with extra test bars and impression balls in a small case. The instrument consists of a metal tube supported in a soft rubber head and a rubber spacing block. The tube holds the bar of known hardness. An anvil in the top of the rubber head rests directly on the bar. Below the bar an impression ball secured in a narrow aperture in the base of the head comes in direct contract with the metal to be tested.

To make a test the instrument is held against the specimen and the anvil is struck a sharp blow with a hammer. The impact is transmitted through the anvil to the bar, then to the ball and on to the specimen. The diameters of the ball impressions in the bar and in the specimen are reported to be relative to their individual Brinell hardness number. These diameters are measured in $^1/_{10}$ millimeters by the microscope, and the comparative BHN is figured. For literature fully describing the Telebrineller and its use, write Telewald, Inc., Railway Exchange Bldg., Chicago, Ill.

A New Power Shovel

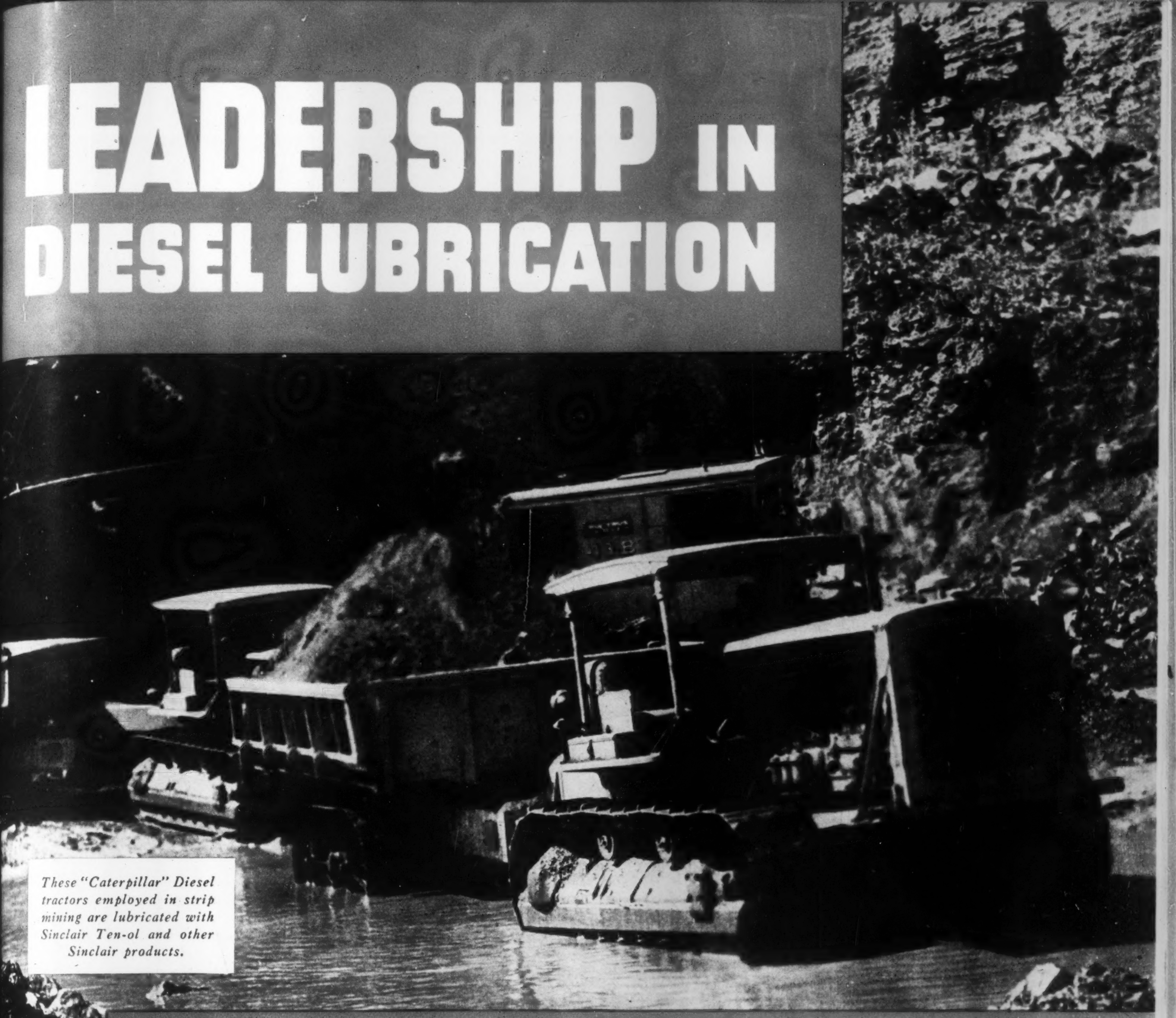
THE 33-B, A 1$^1/_4$ YD excavator convertible for shovel, dragline, clamshell, crane, or dragshovel service has recently been announced by the Bucyrus-Erie Company. Modern alloy steels and welded construction have been used to produce a machine that combines smooth working operation, high speed, high mobility, and ample strength to give steady dependable service in the heavy digging expected of a machine of this size.



The 33-B has many unusual features. A few of them are: longer caterpillar frames to reduce "nosing in" when digging; welded box-girder boom; powerful, modern hoist and chain crowd; dipper having maganese steel casting, "V" type front, with sockets for Bucyrus-Erie patented inserted teeth and having curved plate door; all high speed shafts operate on ball or roller bearings; elimination of deadweight; and big wide-faced clutches.

In the 33-B, power rides on anti-friction bearings direct to the point of action. This simplicity means less friction, easier acceleration, higher cycle speed, quicker control. A choice of three different types of power is offered: gasoline, Diesel or electric. For further particulars and specifications write to the Bucyrus-Erie Company, South Milwaukee, Wis.

LEADERSHIP IN DIESEL LUBRICATION



These "Caterpillar" Diesel tractors employed in strip mining are lubricated with Sinclair Ten-ol and other Sinclair products.

SINCLAIR TEN-OL

REG. U. S. PAT. OFF.

Less than a year ago Sinclair introduced Ten-ol, a lubricant as rugged in service performance as the "Caterpillar" Diesel engines for which it was developed.

Wide acceptance put Ten-ol to the most convincing of tests—showdown of performance under the toughest operating conditions. For example, in mining and quarrying... in road building ... on public projects.

"Caterpillar" Diesel operators find Ten-ol increasing service hours, giving sustained top-notch engine performance, and providing full lubricating protection under emergency overloads. That's why it is recommended as a "new, outstanding Diesel engine lubricant" by Caterpillar Tractor Co.

Try Sinclair Ten-ol and Sinclair Diesel fuel. Order them and other Sinclair products from your local Sinclair office, or write Sinclair Refining Company (Inc.), 630 Fifth Avenue, New York, N. Y.

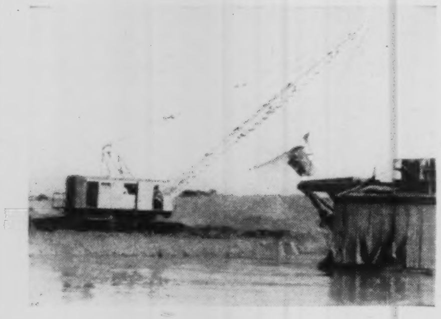
Copyrighted 1937 by Sinclair Refining Company (Inc.)

SINCLAIR TEN-OL

is recommended as a "new outstanding Diesel engine lubricant" by Caterpillar Tractor Co.

New P&H $2^{1}/_{2}$-Yd Dragline

The Harnishfeger Corporation presents the P&H Model 955-LC Dragline as a light, fast, $2^{1}/_{2}$-yd machine to give bigger production on all classes of dragline work. With 80 to 100 ft aluminum boom it has wide working range.



For maximum stability with lowest possible ground pressures, the Model 955-LC has been provided with exceptionally long crawlers, accommodating shoes 30, 36, or 42 in. in width. Driving wear is taken on hardened steel link pins, with each pin capable of taking the entire driving load. A new swiveling type fair-load, large diameter, light-weight sheaves, chilled, curved check plates, and easy swiveling action keep the cable properly spooled on the drum and pulling in direct line at all times. Rugged alloy steel sections are welded together to form a rigid upper revolving frame that is machined as a unit after welding to insure perfect alignment of all working parts. The all-welded, circular lower car-body is reinforced by powerful X-frame construction. It combines with a new, simplified steering mechanism to make the 955-LC easier to maneuver. Hoist and digging drums are mounted tandem fashion to assure true direct line loads from fair-load to drum. There are no off-side line pulls to cause excessive cable wear or overlapping of cable on the drum.

The Model 955-LC is powered by a 185-hp 8-cylinder Diesel engine. Other features include helical gear drive throughout, roller bearing mounted drums, clutches and shafts, big live roller circle that supports the revolving end and is tied to the lower car-body by the use of hook rollers to insure perfect balance on long boom operations. Further information on this machine may be obtained by writing the Harnishfeger Corporation, 4400 West National Ave., Milwaukee, Wis.

A New Detonating Fuse

Primacord is the registered name of the new flexible detonating fuse perfected by the Ensign-Bickford Co. Many advantages are claimed for this new product. It is insensitive. It can be handled quickly and easily, due to its strength, light weight, and excellent waterproof qualities. It is instantaneous. It increases the efficiency of an explosive charge and it is economical.

An illustrated, descriptive booklet on Primacord-Bickford will be supplied by The Ensign-Bickford Company, Simsbury, Conn.

Electrodes for Welding with Small A.C. Transformer Welders

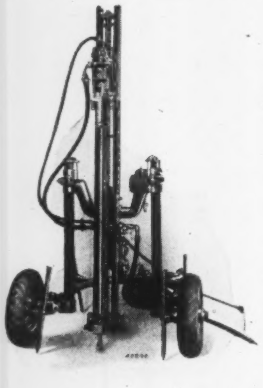
A new mild steel arc welding electrode, designed particularly for use with small alternating current transformer type arc welders, which is said to simplify welding with this type of equipment and provide weld metal of high quality, is announced by the Lincoln Electric Company, Cleveland, Ohio.

The new electrode, designated "Transweld," has a very heavy extruded coating, and, unlike ordinary electrodes used with small alternating current welders, has a very stable arc, easy to strike and hold. Because of its stable arc the electrode permits making welds in smooth well-shaped beads. Another advantage is that slag is easily removed from "Transweld" deposits.

Weld metal produced by the electrode possesses high physical properties. Tensile strength is 75,000 to 85,000 lbs per sq in., yield point 60,000 to 68,000 lbs per sq in., and ductility 20 to 30% elongation in two inches. "Transweld" is made in three sizes: $^{3}/_{32}$, $^{1}/_{8}$, and $^{5}/_{32}$ in. The smaller size comes in 12 in. lengths, the other two in 14 in.

FM Wagon Drill

Ingersoll-Rand Company, 11 Broadway, New York City, announces its new FM-2 Wagon Drill. A distinctive feature of this new light-weight drill, according to the manufacturer, is a ratchet, by means of which one man can quickly raise or lower the drill guide on the uprights. This drill has the same automatic, positive feed at any angle, which proved so successful on the previous model. This air-motor controlled-pressure feed provides an infinite range of feed pressures from 1 to 1000 lbs. A worm gear, which transmits power from the air motor to the feed chain, is self-locking, eliminating all thrust and shock to the motor, and preventing the drill from dropping or jumping forward.



The FM-2 wagon mounting uses the same fast and powerful drills as the larger wagon drills and will accommodate a six-foot steel change. Twenty-foot steels are easily handled. The FM-2 is built for continuous, heavy-duty operation, yet it is light and has the versatility of a Jackhamer. Copies of bulletin 2253-A may be obtained from any Ingersoll-Rand office.

Folders Announced

Cold Water Concreting—is the title of an "Incor" booklet which covers the problems of concrete construction during the winter months. Clear, detailed tabulations add to the technical value of this booklet. Lone Star Cement Corporation, 342 Madison Ave., New York, N. Y.

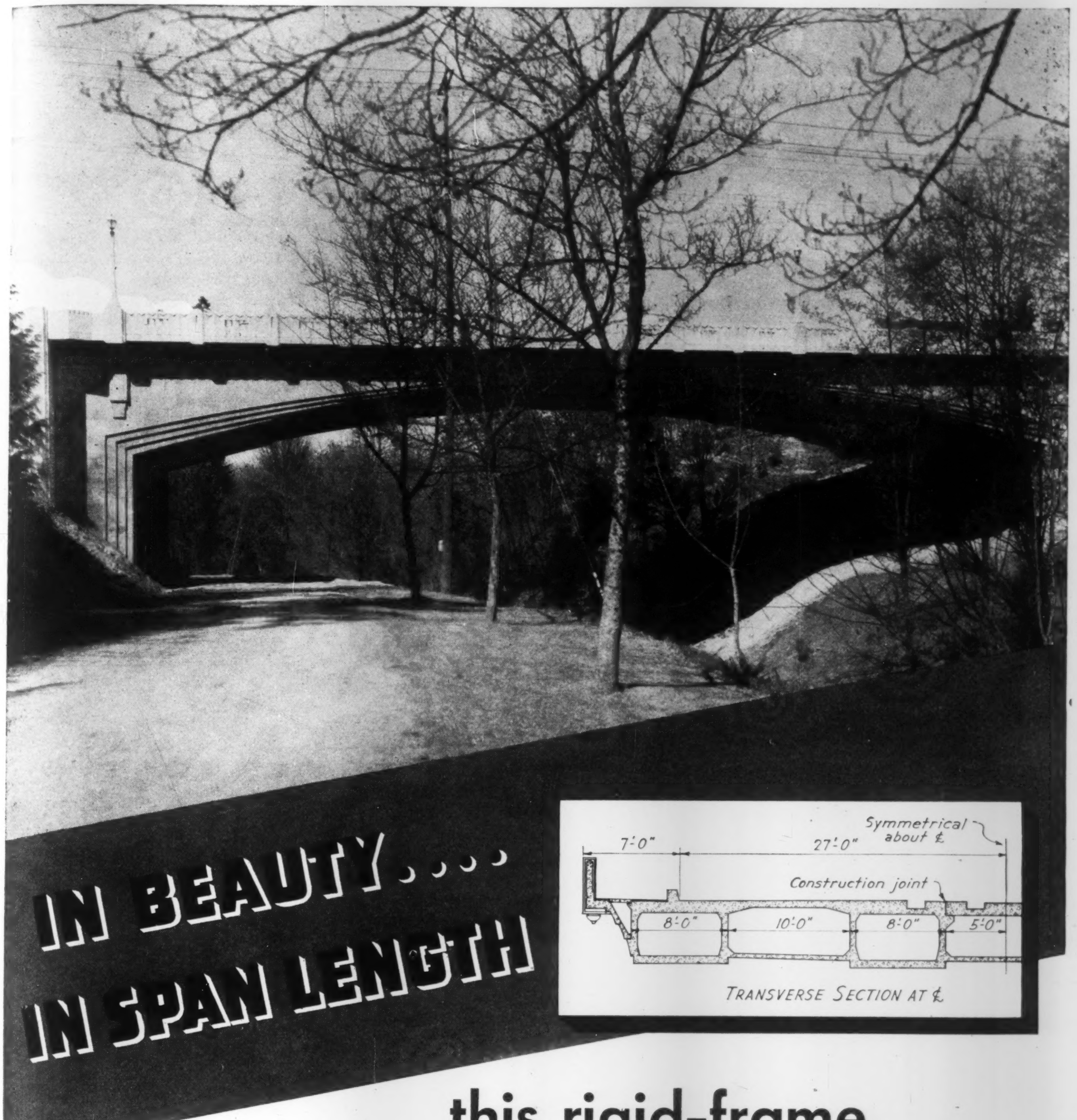
Corrugated Sewer Pipe—Consulting engineers, city engineers, municipal officials and others directly interested in sewer construction will be interested in the beautifully illustrated new 48-page handbook titled, "Armco Paved Invert Pipe Sewers." Tables indicate the recommended joints, and standard and special fittings for Armco sewers. Costs of pipe sewers, loading and hauling, excavating, laying, lining, and joining are discussed in detail. Seventeen pages in the book are devoted to general data for all types of installations, and to specifications for Asbestos Bonded Armco Sewer Pipe. Armco Culvert Mfrs. Association, Middletown, Ohio.

Joists, Steel—Two types of open-web steel joists are illustrated and described in a new Bethlehem booklet of 32 pages. The welded joist has a web of round bars bent to form a Warren type truss and top and bottom chords of hot-rolled angles in pairs, all welded together by electric pressure. The expanded joist is one piece, manufactured by a process of hot rolling, slitting, and expanding. The chords are T-shaped and the expanded web is integral with the chords at panel points. Bethlehem Steel Co., Bethlehem, Pa.

Nickel and Its Alloys—Bulletin T-13—covers in 32 pages of technical information the use of nickel and nickel-base alloys in the design of corrosion-resistant machinery and equipment. The design and construction of heavy equipment in Monel, nickel and Inconel are carefully treated in Bulletin T-14, of 24 pages. Both are prepared by the Development and Research Division, International Nickel Co., Inc., 67 Wall St., New York, N. Y.

Paving Brick—The story of the advantages and durability of vitrified paving brick is briefly told and convincingly pictured in a recent folder. National Paving Brick Association, National Press Bldg., Washington, D. C.

Pipe—A new illustrated book, Form TR-11A, "Transite Pressure Pipe," tells how asbestos-cement pipe is manufactured and describes the tests made on Transite Pipe in the Johns-Manville factories. The ways in which Transite Pipe is said to lower installation, operating, and maintenance costs are explained in separate sections of this volume. Data on the cost of pumping water is given, with a summary of the flow tests on Transite Pipe conducted by the Pitometer Company. Other technical information includes the results of an investigation conducted by a committee of the New England Water Works Association to determine the flow coefficient trend of water pipe, and a chart adapted from the Williams-Hazen tables, which shows the horse-power required to overcome friction in water pipe. Johns-Manville, 22 East 40th St., New York, N. Y.



this rigid-frame concrete bridge sets a record!

Concrete is bringing a new order of architectural beauty to bridges of all sizes and for all types of service. A new order of economy, too. For concrete permits beauty to be attained without complicating the structural design of the bridge or materially increasing its cost.

Concrete bridges are enduring, moderate in first cost and require almost no maintenance.

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Dept.12-13, 33 W. Grand Avenue, Chicago, Illinois

A National Organization to Improve and Extend the Uses of Concrete

Schmitz Park Bridge was designed by the Bridge Division of the Seattle Engineering Dept. under the supervision of C. H. Eldridge, now bridge engineer of Washington State Highway Dept. J. A. Dunford supervised construction. N. C. Carle is City Engineer. Schuehle Bros. were the contractors. 175 ft. center to center of hinges; 54-ft. roadway; two 6-ft. sidewalks. Cellular construction was used in both deck and vertical legs. The hollow frames are internally braced by transverse stiffening frames and heavy fillets, thus creating a strong, rigid, massive-looking structure with a minimum of materials.

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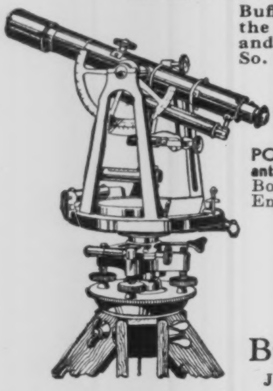
All makes—intelligently repaired and regraduated by Factory Experts. The **finest work** at the **LOWEST POSSIBLE COST.** Reliability and **guaranteed work.** A special Souvenir Plumb Bob sent gratis to graduate Civil Engineers.



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THE Hardest BRONZE
THE Simplest DESIGN

Buff & Buff Company
Jamaica Plain, Massachusetts

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TRADE MARK

CONCRETE VIBRATORS and CONCRETE SURFACERS

By using the MALL method of concrete vibrating and surfacing, concrete of superior quality and appearance can be secured in comparison to hand puddled and hand rubbed concrete.

Placing dry mixes of concrete with a MALL universal electric vibrator

It will pay you to investigate these efficient labor-saving, quality-improving tools for your next job. We suggest that you write for bulletins today!

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7752 South Chicago Avenue, Chicago, Illinois
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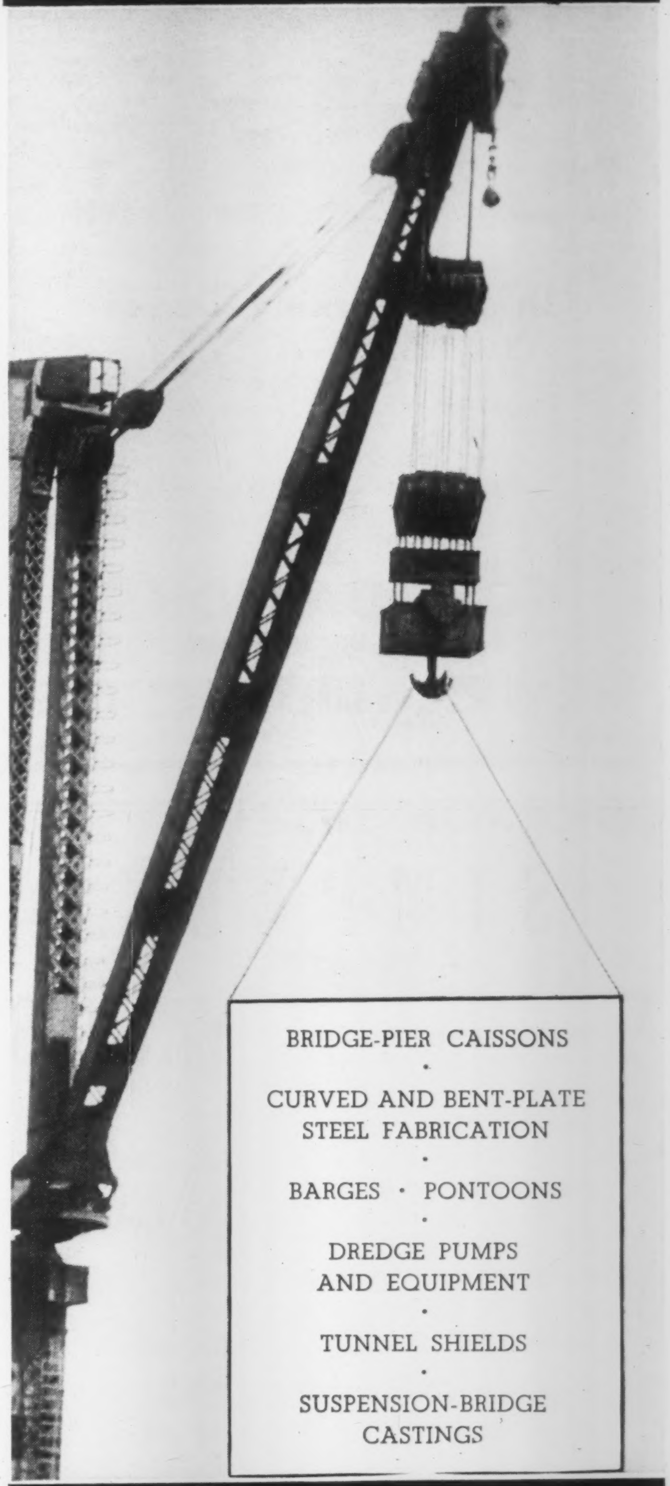

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LIFT ON JOBS LIKE THESE

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Lincoln Highway, USS Kearny, New Jersey
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1131 Tuba Steel Cylinders were required for the support of Stockhouse "D" of the F. & M. Schaefer Brewing Co. in Brooklyn, N. Y. Spencer, White & Prentis drove these foundation piles in thirteen working days—a typical example of the work of this organization.

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PRETEST UNDERPINNING
PATENTED
SPENCER, WHITE & PRENTIS
NEW YORK **DETROIT**

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AIR RELEASE VALVES
For
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"Whenever Air Accumulations Are to Be Automatically Vented Specify SIMPLEX"

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WYCKOFF
Since 1855

REDWOOD PIPE LASTS LONG AND SAVES MONEY

It has 14% greater carrying capacity than metal pipe; Resists frost where severe winters raise havoc with metal pipe. Redwood is the greatest Rot and Heat Resisting Wood known. Can be laid above ground or buried without danger. Not effected by Electrolysis, soil conditions, worms, insects, or the famous termite of the tropics. It does not fill up or corrode; weighs about 1/3 as much as metal pipe and more easily installed. Neither contracts nor expands with heat or cold. Can be laid in wettest kind of trench. Wyckoff Redwood Pipe made of all Clear Heart Stock California Redwood (no knots or sap), in sizes of 1" and up, maximum lengths 12 feet, tenon and socket joints, for pressures to 172 pounds, is used extensively for Water Supply Lines, Penstocks, Sewage, Chemicals, Paper Mills, Tanneries, Fisheries, Mines and Fume Stacks. We can furnish selected Canadian White Pine or Oregon Fir Wood Pipe if specified. We also manufacture Underground Wooden Steam Pipe Casing. Carload shipments can be made one day after receipt of order.

A. WYCKOFF & SON COMPANY, ***Office and Factory,*** **60 Home Street, ELMIRA, N. Y.**

The Originators of Machine Made Wood Pipe ***Catalogue and Specifications Furnished on Request***

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EVERY HAMMER BLOW COUNTS

You Get Greater
GROUND-GRIP
with

UNION METAL
fluted steel
PILE SHELLS

It is the fluted design which provides Union Metal Pile Shells with greater ground-gripping capacities. Fluting gives them more skin frictional area per given diameter than other types of piling. Every square inch of the shell's surface is in intimate contact with the soil. The increased bearing area thus obtained enables them to support the usual load value with a high factor of safety.

Fluted design plus cold rolling also makes for a light weight shell construction of great strength and rigidity. Union Metal Pile Shells are easily handled; require no core or mandrel; can be driven by any contractor with ordinary crane, standard leads and light hammer.

If you want the facts on how to install better cast-in-place concrete piling at a saving, write for new catalog on Union Metal Pile Shells.

THE UNION METAL MANUFACTURING CO.
CANTON, OHIO

Tests show that Union Metal Pile Shells, before filling with concrete, sustain load value with high factor of safety.

60 TON TEST LOAD
PLACED ON
ONE UNION METAL FLUTED STEEL PILE SHELL
LENGTH OF SHELL 80 FEET
SETTLEMENT ¼ INCH in THREE DAYS
FINAL PENETRATION 30 BLOWS
REFUSE INCINERATOR CITY of CLEVELAND, OHIO
SAM EMERSON CO.
BUILDING CONTRACTOR
CLEVELAND
WESTERN FOUNDATION CO.
PILE DRIVING CONTRACTOR

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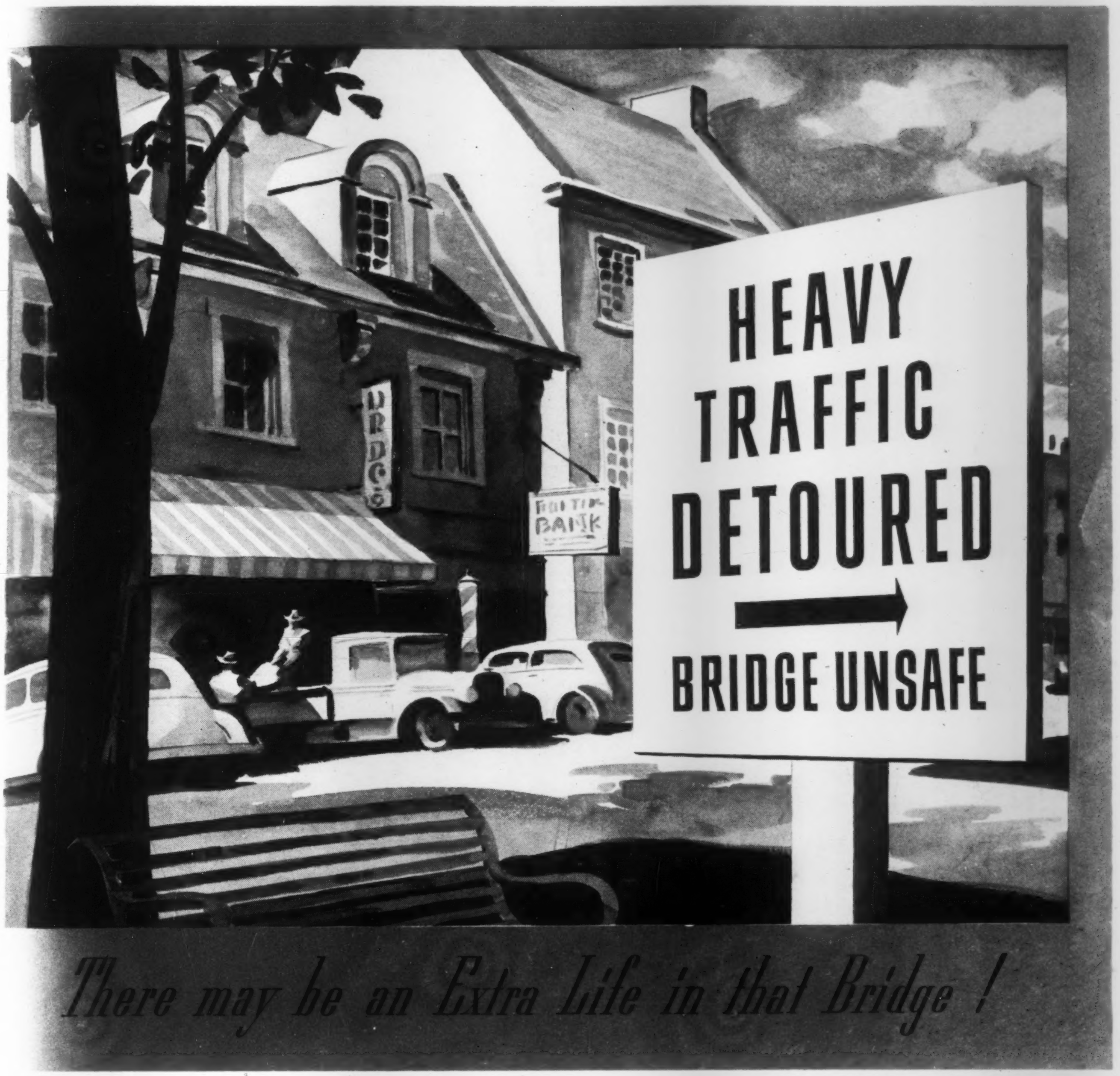

Before complete replacement is prescribed, get the answer to this question: Will a major decrease of dead-load on the existing structure restore serviceability and safety?

In many cases use of light, strong alloys of Alcoa Aluminum for floor systems, walkways, and railings will achieve the required reduction in dead-load and save the structure. The cost is only a fraction of the outlay needed for a new bridge. Usefulness is extended for many years.

Application of Aluminum to give bridge structures extra life has proved its place in sound engineering practice. Bridges so reconstructed demonstrate that: 1. Traffic capacity can be increased; 2. Permissible live load can be increased; 3. Roadway surface can be improved; 4. Stresses can be reduced. ALUMINUM COMPANY OF AMERICA, 2127 Gulf Building, Pittsburgh, Pennsylvania.

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THIS MONTH marks the end of another year's service for many millions of lengths of cast iron pipe installed throughout America, some of which have rounded out or passed the century mark in useful life. In six large cities are more than six million lengths of cast iron pipe comprising 95 per cent of an aggregate of 13,000 miles of water distribution mains. Experience with cast iron pipe—in water, gas and sewerage service—is ample and conclusive as to the *strengths to meet stresses* and the *corrosion-resistance* that add up to a long, economical life. Cast iron pipe is not only a *proved* but a constantly-*improved* product. U. S. Super-de Lavaud Pipe, centrifugally cast in a metal mold without chill, is a notable example.

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ugally or pit cast—for water works,
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